

## PLENARY SPEAKERS



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New Challenges in Industrial Engineering and Operations Management

Ankara Yildirim Beyazit University

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# Conference Proceedings

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International Conference on New Challenges in  
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## New Challenges in Industrial Engineering and Operations Management

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This institute also holds series of courses with the highest academic and applied qualification available, especially in the fields of business, economy, finance, marketing, research methods and information technology. We plan to provide solutions in our training programs that will allow learners the opportunity to learn how to solve the real -world problems and achieve new skills.

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- Hold conferences and events
- Conduct and provide research
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Canadian Institute for Knowledge Development aims:

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- To offer efficient solutions for sharing scientific and experimental findings in various fields
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- To work effectively with universities, institutions and organizations, in order to conduct outstanding research and trainings;
- To provide comprehensive, holistic, high quality and evidence-based trainings which nourishes strengths of learners in a diverse and inspiring environment.



# ANKARA YILDIRIM BEYAZIT UNIVERSITY

The University is established with the purpose of training well equipped individuals to contribute to science and technology with research activities answering to the needs of our age under the light of scientific data as the 97th university in our country and 5th state university in Ankara with 7 faculties, 1 vocational school, 4 graduate schools and 1 conservatory. Since they year 2016 onwards, the university is offering education with 12 faculties, 1 school, 1 state conservatory, 3 vocational schools, 5 graduate schools and 15 application and research centers.

The university will continue to offer bachelor's education in the fields of Medicine, Law, Political Sciences, Humanities and Social Sciences, Business Administration, Engineering and Natural Sciences, Health Sciences, Islamic Sciences and State Conservatory for Turkish Music, Faculty of Dentistry, Department of Civil Engineering established within the body of Faculty of Engineering and Natural Sciences, Departments of Social Work, Sports Sciences, Physical Therapy and Rehabilitation established within the body of Faculty of Health Sciences are going to start offering bachelor education.

**Ankara Yıldırım Beyazıt University (AYBU)** are offering 100% English education in the fields of Medicine, Engineering and Natural Sciences, Political Sciences Business Administration, Department of Psychology of Faculty Humanities and Social Sciences. In addition to bachelor's education, master's programs, non-thesis master's programs and doctoral programs are offered at each faculty. Currently, **AYBU** are offering 49 bachelor's program and 122 graduate programs. With its international bachelor student rate, **AYBU** is experiencing the right proud of being placed on the top among the universities in Turkey.

The experienced, active and dynamic academic staff of **AYBU** is mostly consists of academicians who have obtained their undergraduate/graduate degrees from the pioneer universities of USA, Europe and Turkey. With almost 500 faculty members and more than 1000 academic staff in total, the university has managed to advance its academic human resources perfectly.

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- **Heliyon** (*Abstracted and Indexed in Scopus and Thomson Reuters-ESCI*)
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# **Keynote Speakers' Biography**



## Ali Emrouznejad



*Ali Emrouznejad* is a Professor and Chair in Business Analytics at Aston Business School, UK. His areas of research interest include performance measurement and management, efficiency and productivity analysis as well as data mining and big data. Dr Emrouznejad is Editor of (1) *Annals of Operations Research*, (2) Associate Editor of *RAIOR-Operations Research*, (3) Associate Editor of *Socio-Economic Planning Sciences*, (4) Associate Editor of *IMA journal of Management Mathematics*, and (5) Senior Editor of *Data Envelopment Analysis journal*. He is also Guest Editor to several journals including *European Journal of Operational Research*, *Journal of Operational Research Society*, *Journal of Medical Systems* and *International Journal of Energy Management Sector*. He is also member of editorial boards other scientific journals. He has published over 120 articles in top ranked journals, he is also author / editor of several books including (1) “*Applied Operational Research with SAS*” (CRC Taylor & Francis), (2) “*Big Data Optimization*” (Springer), (3) “*Performance Measurement with Fuzzy Data Envelopment Analysis*” (Springer), (4) “*Managing Service Productivity*” (Springer), (5) “*Fuzzy Analytics Hierarchy Process*” (CRC Taylor & Francis), and (6) “*Handbook of Research on Strategic Performance Management and Measurement*” (IGI Global). For further details please visit <http://www.emrouznejad.com/>.

## Serkan Eryilmaz



He was honored by Science Incentive Award thanks to *his highly qualified studies on system reliability in the field of stochastic models/processes in operations research*. Born in Ankara on 10 February 1978, Serkan Eryilmaz graduated from the Department of Statistics, Faculty of Sciences, Ankara University in 1999 as the top student of the Faculty. Between 1999 and 2002, he served as a Research Assistant in the Department of Statistics, Ankara University from which he received his master degree in 2000 and doctoral degree (Ph.D.) in 2002. Becoming Associate Professor in 2004 and Professor in 2009, Serkan Eryilmaz is now serving as Vice President and instructor in the Department of Industrial Engineering at Atilim University. Serkan Eryilmaz studied at Manitoba University (Canada) and Durham University (England) as a visiting scholar and conducted various scientific studies along with foreign researchers studying abroad. Carrying out research on system reliability, probability and stochastic processes, stochastic models in operations research, Serkan Eryilmaz has written a large number of articles which are published in internationally accepted journals and cited by other researchers. Serkan Eryilmaz has published a number of articles on the evaluation of advanced probability and stochastic processes techniques within the scope of system reliability and the use of these techniques in the reliability analysis of engineering systems consisting of dependent components. Between 2013 and 2016, he worked as “Associate Editor” in IEEE Transactions on Reliability which is one of the leading journals in the field, and is currently serving as “Area Editor” in IISE Transactions and involved in editorial boards of various international journals. He is acting as the committee president of European Safety and Reliability Association which is one of the most important international organizations in the fields of Safety and Reliability in terms of its number of members and activities. He also took part in science and technique program committees of the most prestigious international scientific meetings in the field of reliability.

# Keynote Speeches

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## **Data Envelopment Analysis: Recent Developments and Challenges**

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Ali Emrouznejad

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Data Envelopment Analysis (DEA) is a new tool for measuring efficiency and productivity of decision making units (DMUs). In this talk, we first introduce the standard definition of DEA and further discuss some more advanced models on this topic. When using DEA, it is important to note that various interactions can intricate the analysis. For example, changing the modelling technique, or the input or output variables might result in significantly different efficiency scores. Therefore, we will provide a systematic check list that make efficiency analysis less costly, more reliable, more repeatable, more manageable and faster. Hence, this talk will provide the necessary background to work with DEA. We further will discuss recent developments and challenges that could be useful to both academics and practitioners.

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**Keywords: Data Envelopment Analysis, efficiency and productivity**

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## **System Reliability Optimization: An Overview and New Problems**

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The concept of reliability has become more and more important with the rapid change and development in engineering systems. Reliability optimization deals with the design of a highly reliable system that functions more safely and efficiently under specified conditions and constraints. System reliability optimization is of special importance since it is concerned with a balance between reliability and cost. In this talk, some reliability optimization problems such as redundancy allocation problem and optimal replacement time problem will be mentioned and discussed under various scenarios. Furthermore, new optimization problems on systems consisting of multiple types of components will be presented.

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**Keywords: Reliability, Reliability optimization, Optimal replacement time**

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# ABSTRACTS

**\* Indicates Corresponding Author**

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**Conversion of Quarterly Input Data to Demand Prediction with High Accuracy Using Adaptive Neuro-Fuzzy Inference System: The Case of Turkey**

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Yeşim Ok\*

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Energy is the most basic input in the production process for the realization of social and economic development. Non-stockable nature of electricity energy necessitates designing a system that can always meet the demand. This is the most important step of energy system planning. Medium term prediction is important especially for Energy Systems Management in allocating production capacity, market research and network maintenance planning. Adaptive Neuro Fuzzy Inference System (ANFIS) is used for this study with the compilation of the obtained three-month data for twenty years. ANFIS has obtained results with high accuracy versus regression analysis even for crisis periods because of its adaptive architecture covering the whole dynamic system structure. Gross electricity demand could be predicted with % 96.74 accuracy by ANFIS as compared previous studies.

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**Keywords: Adaptive neuro-fuzzy systems, electricity demand forecasting, medium-term, seasonal fluctuations**

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## **Renewable Energy Transition Scenario Analysis for Turkey**

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Fossil fuel thermal power plants constitute large part of the Turkish electricity generation capacity. Turkish government has been developing several energy policy documents to evaluate how various renewable energy sources of the country can be utilized optimally in the generation of electricity next 30 years. We have studied three scenarios in the transition to renewable energy for Turkey; the business as usual (BAU), energy conservation (EC) and renewable energy (REN) scenarios. EC scenario considers use of energy efficient appliances and imposing carbon tax, whereas REN scenario considers increasing the share of the renewables as much as possible in the power generation mix. We have evaluated these scenarios in terms of cost and environmental impact. The LEAP model was used in the study. The renewable energy scenario has been shown to be the optimal energy policy option in terms of cost and environmental impact.

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**Keywords: Renewable Energy Transition Scenario**

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## **Reliability Design of Mechanical Systems Subject to Repetitive Stresses**

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The basic reliability concepts - parametric ALT plan, failure mechanism and design, acceleration factor, and sample size equation were used in the development of a parametric accelerated life testing method to assess the reliability quantitative test specifications (RQ) of mechanical systems subjected to repetitive stresses. To calculate the acceleration factor of the mechanical system, a generalized life-stress failure model with a new effort concept was derived and recommended. The new sample size equation with the acceleration factor also enabled the parametric ALT to quickly evaluate the expected lifetime. This new parametric ALT should help an engineer uncover the design parameters affecting reliability during the design process of the mechanical system. Consequently, it should help companies improve product reliability and avoid recalls due to the product failures in the field. As the improper design parameters in the design phase are experimentally identified by this new reliability design method and recent patents are addressed, the mechanical system should improve in reliability as measured by the increase in lifetime, LB, and the reduction in failure rate,  $\lambda$ .

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**Keywords: Reliability Design, Mechanical Systems, Repetitive Stresses**

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## **Examination of Manufacturing Exports of Turkey**

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Merchandise products are disaggregated into three main classes as primary products (foods, raw materials, fuels etc.), other products (gold etc.) and manufacture products (iron and steel, chemicals, machinery and transport equipment etc.). In this study, due to the fact that vast majority of exports are known to be dependent on manufactured products, manufacturing exports among the whole merchandise exports are investigated for Turkey, which is one of the developing countries to redirect its export policy on the basis of manufacturing exportation. This paper presents a basis for the examination of the manufacturing exports data of Turkey from 1962 to 2016 and how it has changed through the time and emphasizes the importance of manufacturing exports in overall Turkish industrialization. In this study, trend-based forecasting is performed to predict future manufacturing exports (in percentages) from 2017 to 2019. Results of this study reveal that there has been an increment in Turkey's manufacturing exports and its dominance in comparison to raw material exportation. Furthermore, this study provides insights about future economic growth of Turkey.

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**Keywords: Manufacturing exports, Trend projection, Statistical data analyses, Economic growth, Industrialization**

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## **Electricity Generation from Renewable and Non-Renewable Energy Sources in Turkey**

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Electricity is the most important input for many activities, especially for industrial processes. Due to the advances in economic development, there is a sharp incremental necessity of electricity generation. As a matter of fact, Turkey is a developing country and its electricity generation has been rapidly growing. From this standpoint, this study examines Turkey's electricity generation data of hydroelectric, natural gas, coal, oil, nuclear and other renewable energy sources from 1960 to 2015 via statistical data analyses, which are conducted to reveal relationships and provide future predicted electricity generation values of Turkey. In this regard, electricity generation is firstly handled within two groups as electricity generation from renewable energy sources (hydroelectric and others) and electricity generation from non-renewable energy sources (coal, oil, nuclear and natural gas). These classifications are made to obtain more specific and accurate results about electricity production processes of Turkey. For further directions, we believe that this study can act as a guideline for energy policy planning for Turkey.

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**Keywords: Electricity generation, ANOVA, Correlation analysis, Trend projection, Descriptive statistics**

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## **A Contemporary Review of Fuzzy Systems: The Challenge of Fuzzy Simulation**

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Simulation, which has been extensively used since the world war II, is an experimental technique and is applied for modelling in engineering applications. Simulation is used especially for the complicated systems which are hard or expensive to model mathematically. There are also various successful applications of simulation technique in the literature. In the last decade, fuzzy systems and fuzzy system implementations gain increasing importance because of the needs of engineering systems. Besides, there is no accomplished or agreed upon fuzzy simulation approach in the literature. When the studies in the literature related with fuzzy systems are researched, almost all of them mentioned about different difficulties of solving fuzzy systems and modeling fuzzy systems for their solutions without proposing any solution. Because of these mentioned issues, we aim to evaluate and review the literature about fuzzy simulation to list the important difficulties of generating an accomplished solution technique and modeling of fuzzy systems. By completing this study, we aim to give a lead to future studies about modeling and solution techniques of fuzzy systems.

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**Keywords: Fuzzy Systems, Fuzzy Sets, Simulation, Fuzzy Distributions, Fuzzy Relation**

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## **A New Multi-Criteria Decision Making Approach in the Evaluation of Innovative Ideas**

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Innovative ideas can be gathered from many sources through crowdsourcing and open innovation approaches since these sources have expanded considerably owing to information and communication technologies. Innovation contests are one of the main tool to gather innovative ideas from different sources. Innovations that will provide solution to the problem of enterprises may come up by gathering hundreds or even thousands of innovative ideas through these contests. What is difficult is the stage that selection of the best innovative idea alternative(s) by evaluating these ideas. In this study, a new multi-criteria approach has been put forward. In this approach primarily, alternatives which took lower score from the dominant or most important acceptance criteria were eliminated. Then Weighted Sum and TOPSIS methods were used as multi-criteria decision methods among the remaining alternatives. After that it was implemented one more step to show whether if the variation of weighted score of acceptance criteria affect the ranking order in each methods. Hereby, a decision model proposal for innovation projects has been presented to make an alternative approach that allows both rapid and correct decision making. Findings show that this method should be an alternative approach to make a decision when there are lots of alternatives.

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**Keywords: innovative ideas, innovation contest, open innovation, lexicographic method, TOPSIS**

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## **An Integer Programming Model for Disassembly System Configuration**

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As the product life cycles have continuously decreased, disassembly system design has been regarded to be important for manufacturing enterprises. Effective design of a disassembly system enables the enterprises to recycle the end of life products with low cost and high utilization of labors. This study focuses on line segmentation problem of disassembly system where the worker assignment and segment determination decisions are made simultaneously. To do so, higher utilization of worker resources is achieved and disassembly operations are carried out by effective worker teams since the worker timetabling and disassembly line segmentation problem taken into consideration concurrently. In order to represent the problem mathematically an integer programming model is developed and NP-Hardness of the problem has been shown by reducing the investigated problem to a problem considered to be NP-Hard in academic literature. In addition, two different heuristic procedures, namely SSGWA and CSGWA, are presented to solve the problem in a reasonable amount of time. According to the computational results, SSGWA heuristic superior to CSGWA heuristic consistently because it takes both line segmentation and worker assignment decisions into account simultaneously.

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**Keywords: Disassembly system configuration, Line segmentation, Worker assignment, Effective worker teams**

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**Choosing Restaurant for Lunch Around TOBB ETU Campus Area by  
the Compromise Decision via AHP**

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Selecting the best preferred restaurant among available options in a campus for students is of the interesting problems. There could be several ways to compare and contrast these restaurants according to students' preferences. These restaurants can be categorized in two main groups: fast food and main food. Students select to order their meal from a restaurant based on many factors. Some main factors that would be considered in this study would be the followings. Service pace that deals with being on time and speed of their process, different options in menu, quality of food and service, price, place conditions and social factors. In order to evaluate the decision making process, AHP method can be used to describe the behavior of the students. Importance matrices can be generated by available data on social media and ordering websites. Consequently, appropriate vectors and decisions can be calculated by relevant procedures.

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**Keywords: AHP, Decision Making, Meal Preference, Food Quality**

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## **Multi-Criteria Decision Making for a Facility Location Selection Using Analytic Hierarchy Process (AHP)**

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For many big companies, it has a strategic importance to select a facility where to locate. Thus, using appropriate method is very crucial. The main aim of this case study is to choose the most convenient location for a new facility using Analytic Hierarchy Process. In the multi- criteria decision making process, each candidate facility location was assessed in consideration of 5 criteria which are distance between main suppliers and the facility, distance between buyers and the facility, demand ratio of each buyers, manufacturing and other costs (labor costs, operating costs etc.) for each the facility, government promotion for the facility. The AHP method includes creating priority weights, setting a judgement matrix and weight vector, and ranking the location alternatives. In the solution, the alternatives were evaluated and compared under quantitative factors for determining the new facility location.

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**Keywords: Location, Selection, Analytic Hierarchy Process, Multi- Criteria Decision, Priority Weight**

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### **Analyzing of Office Satisfaction Level by Using Fuzzy Cognitive Map**

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Fuzzy cognitive map (FCM) can successfully show knowledge and human experience, presenting concepts to show the necessary elements and the cause-effect relationships among the concepts to model the behavior of any system. FCM consists of a number of nodes, representing variables, factors, states, observables, etc., of the modeled system, and of causal relationships among the nodes. This paper purposes to analyze the office satisfaction level, which handles office environment quality, sick building syndrome, and musculoskeletal complaints, by using fuzzy cognitive map. Office environment quality includes temperature, humidity, noise, lighting and air quality. Musculoskeletal complaints include neck, shoulder, arm, wrist, waist and leg. Sick building syndrome includes eye, noise, throat, skin and headache. These criteria and sub-criteria interact each other to other. These interactions are considered by using FCM. The defuzzification method is used to transform to crisp numbers from fuzzy numbers. An aggregation operator can be used to aggregate the judgments of three experts in group decision making environment and the unique judgment is acquired.

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**Keywords: Fuzzy cognitive map, office environment quality, sick building syndrome, musculoskeletal complaints, office satisfaction level**

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## Strategic Plan Measurement and Evaluation Tool (SMET) for Organizations

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The corporate level performance evaluation for strategic management has become a challenge for business world. Over time, many performance measurement techniques have been developed and used to measure strategic level performance. There are some models methodologies developed for this purpose. An outstanding approach, Balanced Scorecard (BSC), has been successful in comparison to others. The primary weakness of all these methods is not to offer clear answers about how the performance criteria defined at the operational level should be reflected to the top of strategic plan's hierarchy.

A methodology was developed by using Saaty scale for prioritization and Simple Additive Weighting Method (SAW) in reflecting the upper level categorization of operational level. With the addition of Simple Multi Attribute Rating Technique (SMART) method to this methodology, a novel decision support system software, called SMET (Strategic-plan Measurement and Evaluation Tool) has been developed. An organization may measure and evaluate its success ratio to satisfy all its objectives with different set of priorities using SMET. An organization which identifies its current strategic plan in SMET will be able to calculate the realization ratio of the firm's strategic plan within seconds based on the three different decision making methods.

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**Keywords: Strategic Performance Measurement, Multi-Attribute Decision Making, Decision Support System, Performance Management**

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## **Advance Human Error Assessment and Reduction Technique Based on Stochastic Multi-Criteria Decision Making**

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Human Error Assessment and Reduction Technique (HEART) is a practical and powerful approach to prioritise errors related to human actions. HEART can determine error producing conditions (EPCs) which cause human errors for different processes. Decisions can be made as to the prevention of potential human errors in the design phase or reduction of the impacts of these errors by additional controls. HEART considers nominal human unreliability probability to determine the most important human errors that should be prevented. HEART is quickly applicable to any situation or industry where human reliability is important. However, it has many deficiencies for real life error assessments. In this context, this study aims to improve effective usage of this technique by implementing multi-criteria decision making based on DEMATEL. The reasons for using DEMATEL is to show the interactions between EPCs. To utilize the proposed approach, an example for steam boiler working process is given.

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**Keywords: HEART, MCDM, DEMATEL, Risk Assessment**

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**A Multi Criteria Decision Making Model for Solving Academic Staff Selection Problem: A Case Study from Turkey**

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To catch up with the developments in the scientific and technological areas around the world, the academic staffs' recruitment and qualification become crucial in Turkey. For this reason, multi criteria are considered for academic staff selection in universities in recent years. The academic background, academic publishing, attending international conferences, knowledge of foreign languages, computer abilities, project, patents, predisposition to teamwork and social skills are the most significant criteria for academic staff selection. In this paper, the six candidates' data are received and examined, who apply for selected pilot university in Turkey. By using integrated Fuzzy Analytic Hierarchy Process (FAHP), TOPSIS and ELECTRE methods, the eligible candidate is determined for a certain academic position under nine criteria. For determining the criteria weights, the FAHP method is applied. TOPSIS and ELECTRE methods are used to obtain the final ranking. Next, the results derived from TOPSIS and ELECTRE methods are compared in order to determine which method is appropriate for this problem.

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**Keywords: ACADEMIC STAFF SELECTION, MULTI CRITERIA DECISION ANALYSIS, FAHP, TOPSIS, ELECTRE**

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## **Selection of Renewable Energy in the Central Anatolia Region from Turkey**

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Many reasons such as developments in the field of industry, technological progress and population growth cause the use of energy resources to increase rapidly. Limited fossil fuels are known to be inadequate in future periods and desire of capturing fossil resources by countries is increasing day by day. Moreover, unconscious use of energy resources and rapid depletion of available resources causing people to search for different energy sources. Decreased of the life of currently used fossil fuels and negative impacts on the environment and human health causes countries to turn to renewable energy sources. Renewable energy sources such as solar, geothermal, wind, biomass and hydropower are the preferred alternative energy sources in recent times. For this reason, while investments and incentives are being made, countries are aiming to determine the most appropriate renewable energy source to use the existing possibilities of the regions efficiently. In this case study, renewable energy resources in Central Anatolia Region in Turkey are examined and accordingly the selection of the types of renewable energy to be used is emphasized. It is aimed to determine the types of renewable energy to be used in Central Anatolia region with tangible data, criteria and expert opinions determined by multi criteria decision making methods. The hydroelectric, wind, biomass, solar and geothermal energy resources of the region are listed and investment priorities to be obtained.

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**Keywords: Renewable Energy Resources, Multi-Criteria Decision Making, Central Anatolia Region, Turkey**

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## **Prioritization of Humanitarian Relief Flow between Districts Using TOPSIS: A Case Study**

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This study focuses on presenting a multi-criteria decision-making (MCDM) method to determine prioritization among demand points for aid distribution in case of supply shortage. Relief agencies are responsible for distributing limited amounts of goods to the ones in need. One of the challenges that humanitarian relief networks presents is determining optimum allocation. Since the decision about allocation of supplies is the key of equity, it is supposed to be based on comprehensive analysis of target areas with numerous criteria such as demographic, economic, and social conditions. Variability of the needs of different groups of people at different times creates an uncertain environment. The fuzziness in the data is represented as fuzzy decision matrix. To handle this MCDM problem while dealing with the fuzziness, Fuzzy TOPSIS is utilized. A case study in Turkey with data from authorized sources is included in the paper to clarify the outcome of the proposed method.

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**Keywords: TOPSIS, Fuzzy TOPSIS, Multi-criteria decision-making, Humanitarian logistics, Turkey**

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## **6S Transformation in a Modular Manufacturing System: A Case for Implementation**

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Kübra Çiftçier

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Nowadays, manufacturers' attempt to keep their company on highest level of efficient by eliminating wastes. In this study, 6S is used as a tool for reducing wastes in the case company. 6S is a modified version of the 5S methodology that includes "Safety" as the sixth S. The case company, producing modular products, which makes the company different from other similar studies. Modular design is a design approach that a complex product subdivided into smaller parts called modules or skins, the modules can be independently created and then used in different systems. In first part of the project, all the waste sources are identified and then 5S stages including sort, set in order, shine, standardize and sustain is applied. In the second part (sixth), workers and working environment is considered as the main source of waste so based on motion analysis, working environment, and workbenches ergonomic analyses is performed using ErgoFellow software. All the factors which cause high level of emergency were determined and relatively solutions were offered to eliminate overburdens on workers.

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**Keywords: Manufacturing, lean production, productivity**

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## **A Not-Cyclic Modeling Approach for Control and Planning Modular Construction Project**

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Aiming to increase efficiency, this study proposed a control and planning approach for a modular construction system using Petri Nets. For do this, Petri Nets is used to visualize production area in a detailed way and creating a platform for control of the system. Since in modular construction system for each specific project a new plan is required, simulating the system by common cyclic methods in not feasible so a new not-cyclic modeling approach is proposed in this paper for handle the flexibility of the modular construction projects. This approach allows running more than one of project simultaneously. The control places running logic is explained by using matrix methodology. Furthermore, for supporting standardization logically and computationally matrix methodology and linear programming was used respectively.

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**Keywords: Petri Nets, standardization, productivity**

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## **A Comparison of Different Decision Analysis Processes for Electric Vehicle Charging Station Deployment**

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Scarcity in near future, and the price fluctuation of fossil fuels lead to many industries change their products that use these resources into eco-friendly versions. One of the noticeable example of this situation is the automobile industry. As a result of this, electric vehicles have started to become more popular. Since electric vehicles have a limited range for transportation before they require charging, the number and the positions of charging units become very important.

In this paper, we plan to conduct a study on electric vehicle charging station placement problem. We consider a region of a city with predetermined potential charging points. These points will be in shopping malls, gas stations and certain household areas. In this problem, we plan to use three types of charging stations: Slow, normal and fast. Then, a survey or a provided dataset will be used to evaluate criterion. These criterion are planned to be accessibility, traffic convenience, waiting time and walking distance. For the evaluation process AHP, ANP and TOPSIS will be used. As a main tool for charging station deployment, an integer programming model, which maximizes electric vehicle drivers' utility in term of evaluation results, will be developed and the effects of different evaluation techniques' on deployment procedure is shown and compared.

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**Keywords: AHP, TOPSIS, ANP, Electric Vehicles**

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## **Choosing the Best Material from Suppliers to Purchase Using Analytic Hierarchy Process (AHP) Method**

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In this case, our aim is to apply Analytic Hierarchy Process (AHP) Method for choosing the best suppliers which meet firm's demands. The goal is to determine most efficient and suitable material for our products. In order to reach this goal, we have set some criteria that we think is important for suppliers to achieve. These are cost, minimum order quantity, payment flexibility, location of supplier, delivery time, adapting to demands, quality. We decided to use AHP Method because it very easy to understand and implement by executives. This method is used when choosing a multi criteria decision with a large number of decision makers. The hierarchical structure of AHP shows the relationship between the main objective of the problem, criteria, sub-criteria and alternatives.

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**Keywords: production planning, material planning, decision making, analytic hierarchy process method, materials management, minimum order quantity**

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## **Selecting the High-Performing Departments Applying AHP-ELECTRE MADM Methods**

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In the performance evaluation systems (PES), departments are evaluated in terms of their key performance indexes(KPI). The total actualization score of weighted kpi's determines the departments' performance scores that are used for ordering department from higher- performing to lower performing. However, this method does not take into consideration differences among the departments. In this study, to determine the high ranked departments within a company, multi-attribute decision-making (MADM) processes are applied in view of the fairness. Two main stages exist as a framework of the study. First, to decide the attributes precedence pair-wise evaluation matrixes are created via analytical hierarchical process (AHP). In the second stage, Elimination and Choice Expressing the Reality (ELECTRE) approach is used to rank the departments using attributes weights obtained from AHP. At the end of the study, a case study is given to show how the departments are ordered as a function of performance management within a company that uses balance-scorecard application for performance evaluation.

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**Keywords: Multi-Attribute Decision-Making (MADM), AHP, ELECTRE, Performance Evaluation Systems (PES) , Department Ranking**

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## **Performance Management of Supervisors in Railway Company: A Case Study**

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Many contemporary organizations are placing a greater emphasis on their performance management systems as a means of generating higher levels of job performance. Performance evaluations are often used for pay, promotional and retention. We suggest that producing performance increments may be best achieved by orienting the performance management system to promote employee engagement.

Using rail way grow rapidly regarding this Internal operations of trains become even more important. In this situation Turkey has 52 high speed and 8 conventional services daily.

The purpose of this research was to enhance efficiency of supervisor by improve the new performance system of supervisor that working for High Speed Trains and Conventional Trains by using TOPSIS (Technique For Order Preference By Similarity To An Ideal Solution) method and AHP (The analytic hierarchy process) which is one of the multicriteria decision making methods. For that purpose by using the mostly used criteria (sales quota, survey, measure of technical knowledge) from the operation equal weights were given to criteria, and the performance scores were obtained.

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**Keywords: TOPSIS, AHP, Internal Operations of Trains, High speed Train, Conventional train**

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**Decision Analysis of the Solar Energy System Investment in Turkey  
with AHP, Promethee and Electre Method**

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In recent years, energy planning using Multiple Criteria Decision Making (MCDM) techniques is attractive to decision makers. The techniques could solve complex energy management problems. This paper determined that installing solar energy system would be more appropriate to make an investment in which area of Turkey by comparing the results of Analytic Hierarchy Process (AHP), Elimination Et Choix Traduisant la Réalité (ELECTRE) and Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE) which are the most popular MCDM methods in energy sector. This study deals with the decision making for optimum investment plan comparing by these methods' solutions. For this purpose, some criteria should be considered as maintenance cost, substructure setup cost, being in the incentive zone, energy transfer cost, work safety risk, amount of productivity in areas, ruggedness rate of areas, suitability for installation in areas, substructure setup time, sunshine duration, the angle of the sun daylight, amount of wind blowing, productivity and amount of energy demand. In the result of this study, decision's quality is analyzed to make investment more explicit, rational and efficient.

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**Keywords: Solar energy system, multi criteria decision making, AHP, ELECTRE, PROMETHEE**

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## **Department Allocation for a Store Layout: An Application of Quadratic Assignment Problem**

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One of the main goals of a manufacturing or service system is the maximization of its productivity. This aim depends on several factors one of which is the arrangement of the departments constituting the production process. The challenge of determining the best arrangement of the departments is one of the elements that have a great impact on system performance. In this paper, a layout problem of a store is considered to find the best arrangement of departments in that store. In the case study, the store has four floors with totally 22 rooms. The objective of the study is to allocate the departments to the 22 available rooms to minimize the total walking distance between rooms while considering the interactions between departments. Thus, it is considered as a quadratic assignment problem (QAP) and as a variant of QAP, an integer programming model is applied to solve this layout problem.

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**Keywords: Quadratic Assignment Problem, Integer Programming, Store Layout, Case Study**

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## **A New Integrated HFL-MAIRCA Method and Application in Cargo Company Selection**

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With the technological developments, competition conditions have become very important and difficult in many sectors. Cargo transportation is part of the logistic sectors. Both service quality and customer satisfaction are very important for companies which provide cargo transportation services. This study aims to evaluate cargo companies via DMs (customers) preferences in Erzurum. Evaluating cargo companies is difficult task for decision makers because of the increase complexity, demands. Evaluating cargo companies is the multi-criteria decision making problem and decision makers (DM) often use uncertain linguistic terms to express their assessments because DMs hesitate among different linguistic terms to provide their preferences. In this study, a new MAIRCA method based on hesitant fuzzy linguistic term sets (HFL-MAIRCA) is proposed for evaluating and selecting the best cargo company. This method can increase the flexibility of representing linguistic information and it can reflect in determining the gap between the ideal and empirical ponderers. From this point of view, alternatives, criterias and DMs are defined and the proposed method is applied selection of the best cargo company.

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**Keywords: MAIRCA, Multi-criteria decision making, Hesitant fuzzy linguistic term set, Cargo company**

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## **An Application on Instant Data, Productivity, Optimization and Route Planning in Smart Waste Management**

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Tendency towards to cities of the people living in rural and increase in number of people living in urban areas makes it necessary for local governments to be more efficient and effective in service delivery. The use of resources more effectively, a sustainable environmental awareness, and the fact that motivation for making cities more livable, has led to the concept of a Smart City.

There are some best practices for smart city applications that make people's life easier. For example, when a townsfolk that goes to work early in the morning, the lights of the street lamps turn on automatically, the person who goes to the city center for the appointment can find the available parking areas instantly, electric vehicle owners can easily reach the charging station, disabled persons pass across the street safely, the capacity of garbage containers can be monitored remotely, to be able to follow an leak in the water network. Additionally air, and sound pollution values are constantly updated and moved to the center, instant reading of water and electricity meters which will contribute to the protection of resources, to be able to generate an instant alarm in traffic accidents, to be able to learn the driver traffic intensity, traffic light intensity can be arranged according to the traffic.

In this study, instant data collection from the scene through circuit designed by the Internet of things approach and with the help of this collected data, the establishment of an ideal system for the smart waste collection system for cities and it is aimed to support sustainability in the cities by integrating it with city administration information systems.

The analytic hierarchy process will be used to translate the data from this infrastructure that will be integrated into the management information systems and transfer them to decision support systems. As a field of application for this study, an area within the municipal boundaries of Beşiktaş district of Istanbul province was chosen.

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**Keywords: IOT, Smart Systems, Waste Management, Waste Collection, Optimization**

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## **Solving Multi Dimensional Decision Problems with Game Theory by Using Choice-Based Conjoint Data**

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Aim of the study to combine well-known market research technique, Conjoint Analysis' results, which are frequently used to determine customer preferences, with Game Theory as suggested in Choi and DeSarbo (1993). The application of the proposed approach is based on the factors affecting the private (foundation) university preferences of the university candidates and the marketing decisions of the school administrations. After main attributes were appointed by a pilot study, students' preferences were determined by Choice-Based Conjoint (CBC) method with the result of 296 students who were in the process of selection after 2016 university selection exams. The relative weights of marketing strategies of private (foundation) universities obtained from the interviews with the school administrations and the results obtained from the CBC were used as input in the game matrix prepared in the context of Game Theory and the solution was completed as a two-person zero sum game.

As a result, it can be seen how the student preferences change when school administrators change the weights of the strategic marketing factors. In addition to that, with the acquisition of competitor data, this approach allows to describe the market situation in general and to make a university-based comparative assessment.

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**Keywords: CHOICE BASED CONJOINT ANALYSIS, GAME THEORY, DECISION THEORY**

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## **Marketing Mix Based Group Decision Making Procedure under Fuziness**

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Marketing mix is the set of marketing tools that is being used to implement marketing strategy of enterprises. Marketing mix elements are the cores in the integrated marketing program, which transforms marketing strategy into the action to build customer relationships. Customer value and profitable customer relationships can be enhanced via marketing mix. All elements of the marketing mix are known to have influences with each other. Marketing mix can be defined as the combination of various marketing decision variables. From this stand point, a real case study is executed in a company which is the supplier of engineering, hand and power tools, automotive products, and etc. In this study, a telephone questionnaire is conducted among 238 customers of the considered company for collecting data regarding services in order to evaluate their performances. Individual customers' preferences are vague and cannot be precisely evaluated with exact numerical values. Instead of numerical values, linguistic assessments can be assessed by the means of linguistic variables for ratings and weights of the criteria. These characteristics imply the applicability of fuzzy set theory in capturing the customers' preferences. In this study, a group decision making procedure is proposed for marketing mix involving customers' preferences under fuzziness.

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**Keywords: Marketing Mix; Multi Criteria Decision Making; Fuzzy Set Theory**

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## **An Integrated Approach for Mobile Phone Selection**

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Fuzzy quality function deployment (QFD) approach has been widely applied to transform customer requirements into products or services because fuzzy numbers enable to make consistent decisions in uncertain environment to decision makers. This paper proposes to use interval type-2 fuzzy (IT2F) numbers in the development of a novel fuzzy QFD approach. The developed interval type-2 fuzzy number based QFD approach utilizes interval type-2 fuzzy sets to define the correlations among customer requirements (CRs); the relations between CRs and design requirements (DRs); the correlations among DRs, the weights of DRs. There is no paper about integrating QFD approach and IT2F set in the literature. IT2F numbers ensure us more information than type-1 fuzzy numbers to describe the fuzziness and the uncertainty of the real life world. In addition, TOPSIS (Technique for Order Performance by Similarity to Ideal Solution) method based on interval type-2 trapezoidal fuzzy (IT2TrF) is utilized to select the best mobile phone. Finally, the proposed approach has been implemented to a mobile phone selection in order to test its validity.

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**Keywords: Quality function deployment, fuzzy logic, TOPSIS, interval type-2 fuzzy number, mobile phone selection**

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## **Performance Evaluation of Logistics Companies by Using Fuzzy Analytic Hierarchy Process and an Application**

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In recent years, there is an increasing competition in markets. In order to survive in this competitive environment and to be able to see to what extent the companies have achieved their targets, made performance evaluation in their own internal processes is required. One of these processes is the concept of logistics. The concept of logistics, which is an improved expression of the concept of transportation, has become one of the most important tool. It also plays a role in the improvement of economic indicators. Therefore, companies have begun to make more efforts to improve their logistics performances. In this study; the Fuzzy Analytical Hierarchy Method has been applied to the performance evaluation of a large logistics company. The main criteria are Efficiency, Effectiveness and IT and Innovation. Also there are 15 sub criteria. The criteria weights were determined by using the fuzzy AHP method and performance evaluations were made according to the results collected from the questionnaires.

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**Keywords: Fuzzy AHP, Logistics, Performance Evaluation**

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## **Integrated Fuzzy-Based ANP-CODAS Methodology for Personnel Selection Problem under Fuzzy Environment**

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All organizations have to get qualified and professional human resources because of the increasing competition conditions and technological improvements recently. Companies can manage this situation by selecting the most appropriate candidates for jobs or tasks featly. Personnel selection is a crucial and compelling process. The main goal is to assign the most suitable candidate for the required job or task by avoiding possible selection mistakes. This process, regarding a lot of evaluation criteria such as communication skills, professional experience, educational background, and team management, can consist of more than one decision maker. For this reason, a hybrid method based on fuzzy ANP-CODAS methodology is presented for personnel selection problem under the fuzzy multi criteria group decision-making environment. A case study is conducted, and the results are discussed. Finally, it is seen that the method which is practical and relatively less effortful produces better decisions to help the managers under fuzzy circumstances.

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**Keywords: Personnel Selection Problem, Multi Criteria Group Decision Making, Fuzzy Environment, ANP, CODAS**

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## Design of Material Handling Equipment for in-Cell Logistics Using Fuzzy DSM

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As a result of the rapid development of technology and innovation, new products are being introduced into the market incessantly and cause the products on the market to quickly get old and unpopular. This ongoing competition forces companies to develop new products in less time to meet the needs of customers. In this context, optimization of new product development process has become an important factor. In this paper, a fuzzy design structure matrix (FDSM) that combines fuzzy set theory (FST) and the design structure matrix (DSM) is presented for the design of material handling equipment. The proposed fuzzy design structure matrix is divided into independent groups and able to improve the performance of design process of the new product by decreasing the number of component iterations and the cost and by offering possible product variety. A real case study for the design of light load AGVs known as material handling equipment suitable for intracellular usage is conducted.

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**Keywords: Fuzzy set theory, Decision structure matrix, New product development, Material handling equipment**

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## **Analysis for Turkey's Self-Sufficiency in Electric Energy Sector and the Role of Renewable Energy**

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Renewable Energy Sources (RES) is vital for self-sufficiency of countries because it is, unlike fossil fuels, environmentally friendly, domestic and most importantly sustainable sources. Nevertheless, a large proportion of Turkey's electricity demand is satisfied with fossil resources such coal and natural gas. This situation not only makes our country dependent on foreign sources but also jeopardizes our energy supply security. However, Turkey has a great potential of renewable energy that could provide self-sufficiency in electricity sector. In this study, Turkey's self-sufficiency in electricity sector between the years of 2000-2016 is assessed using Data Envelopment Analysis (DEA). Also, this study discusses the place and importance of RES for self-sufficiency. CCR model, one of the DEA methods, was built with two inputs; total primary energy supply and gross domestic product, and three outputs; export-import rate, domestic production and generated electricity by RES. The analysis shows that Turkey's self-sufficiency in electricity sector has been worsening recently. The main reasons for this deterioration are the high energy demand, increasing reliance on imported natural gas and hard coal, and underutilization of RES. Therefore, to become self-sufficient, Turkey should give priority to RES and utilization of RES should be promoted by using appropriate incentives and policies.

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**Keywords: Self-sufficiency, Renewable Energy, Data Envelopment Analysis**

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## **0 – 1 Integer Programming Model for Multiple Criteria Real Estate Investment Planning**

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Investors should consider carefully for real estate before allocating their capitals. A good investment can bring great amount of profit in a short time, or an investment capital that has not been considered carefully can cause capital to be spent on an idle asset. It will be possible for the investor to make a profit by evaluating the available investment options in terms of economic, legal, location and physical factors. A decision model combining 0-1 integer programming and multi-criteria decision-making techniques is proposed in order to choose investment alternatives in this study. In the proposed model multi-criteria assessment of investment alternatives is done by using Analytical Hierarchy Process and obtained priority values are written as the objective function coefficient in the budget-limited investment alternative selection model. An application of investment planning, which contains 10 alternative real estate investments in Ankara, is presented to demonstrate the applicability of the proposed decision model. Obtained results are compared with the results obtained by only considering financial aspects of investment.

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**Keywords: investment planning, integer programming, multi-criteria decision making**

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## **AHP – VIKOR Approach for Green Supplier Selection**

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Consumers prefer environmentally friendly products in recent years because of the increasing popularity on protecting the environment. Because of this trend between consumers, companies have changed their production processes. The first necessity for production of an environmentally friendly product is to supply less harmless raw materials. Therefore, companies have to supply production inputs from green suppliers in order to produce environmentally friendly products. The main aim in this study is to propose a decision model for determination of the best green suppliers. In the proposed model, Analytic Hierarchy Process (AHP) and Vise Kriterijumska Optimizacija I Kompromisno Resenje (VIKOR) methods are integrated. AHP is used to determine criteria weights and VIKOR is used to evaluate alternative suppliers. 5 main criteria and 17 sub-criteria are taken into account in the model and an application of a textile company is made by using the opinions of a group of four expert personnel of the company. AHP evaluation results show “Green Design” criteria and “Product Quality” sub-criteria are the most important criteria and sub-criteria, and the best green supplier is selected among the alternative seven suppliers by using the VIKOR method.

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**Keywords: Multiple criteria decision making, green supplier selection, Analytic Hierarchy Process, VIKOR**

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## **Home Health Care Routing Problem: Literature Review**

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The vehicle routing problem (VRP) has been expanded by adapting it to problems of location and routing in many areas since the first date it was introduced. One of these problem areas is the home health care routing problem in the health sector, which has attracted many researchers in recent years. The problem of routing home health care operations has been modeled in the literature in a number of ways with unusual side-constraints that make the problem difficult to solve. The problems vary mainly due to the legal arrangements of countries and the different constraints related to patients and/or health care taker. In the scope of this study, the studies in the literature are examined and differences in the models in terms of classification, solution methods, constraints and objective functions are investigated. With demand for home health care expected to increase substantially, one of the main aim of the future work is decreasing the costs and at the same time increasing the quality of service as well as the quality of life of the patients.

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**Keywords: Home health care, vehicle routing problem, literature review**

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## **Development of a Hybrid Electrical Automobile Selection Model Using the Operating Window Perspective Based Taguchi-TOPSIS Model**

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In this study, an operating window perspective based Taguchi-TOPSIS model (OWTTM) is developed for the hybrid electrical automobile selection problem. The operating window perspective based Taguchi application has the option of the multiple attribute values to convert the single-value. Operating window is a range of attributes' values that the operating parameters meet the specified functional parameters yielding the best results in economic and technological terms. The operating window's upper and lower boundaries are defined as limits. More than two limit modes usually cannot be characterized by a one-dimensional operating window. After obtaining attribute values for the hybrid electrical automobile alternatives, the TOPSIS method is used for the ranking of the alternatives. The developed selection model is tested on a case study and satisfactory results are obtained.

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**Keywords: Hybrid electrical automobile, Parameter design, Multi-criteria decision-making, Taguchi method, Automobile selection, Operating window, TOPSIS**

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## **A Evaluation of Close Loop Supply Chain on Recycling of Valuable Waste by the Linear Programming**

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Emerging technology and increasing rate of population are causing rapid depletion of natural resources. The decline in natural resources has forced researchers and governments to take various measures and find various solutions. In recent years, researchers have tried to minimize the need for raw materials and resources by taking the remaining or unused products at the end of the supply chain back into the supply chain at the beginning or intermediate stages. The supply chains established for this purpose are called closed loop supply chains. In this study, the recycling of lubricating oil obtained from crude oil, which is a very limited and expensive underground source that is consumed in large quantities, is discussed. For this purpose, first of all, studies done with closed loop supply chain in literature have been examined. Then closed cycle supply chain has been formed by combining lubricating oil advanced supply chain and reverse supply chain. A mathematical model of the closed-loop supply chain is established. The mathematical model was applied to a sample system and solved with the GAMS package program. The decrease in the amount of crude oil required for lubricating oil and the profit that can be achieved in the long term have been evaluated.

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**Keywords: CLSC, Lubrication Oil, Mathematical Modeling, Natural Resources**

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### **Evaluation of Unmanned Combat Aerial Vehicles with AHP Method**

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With today's technological advances, unmanned aerial vehicles are equipped with advanced technology, weapons and ammunition, and are being used effectively in high-risk operations. Many countries are creating unmanned aerial vehicle armies because they can be controlled by remote control, move without a pilot, and remain in the air for longer than warplanes, and they are equipped these vehicles with decision support systems based on artificial intelligence to develop autonomous systems. In this study, the unmanned combat aerial vehicles used by the countries are analyzed based on the AHP method under various criteria and trying to determine the best from these vehicles. The aim of the study is to determine the deficient and developmental aspects of unmanned combat aerial vehicles. As a result of the analysis, it is determined that Eitan Heron produced by Israel is the best unmanned combat aerial vehicle and useful load carrying capacity is the most important criterion. It is estimated that increasing the useful load carrying capacity and cruising time will significantly increase the task performance of the armed unmanned aerial vehicles.

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**Keywords: Unmanned Combat Aerial Vehicle, Multi Criteria Decision Making, Analytic Hierarchy Process, Modern War Technologies**

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## Ware House Location Selection for an Electricity Distribution Company

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This study investigates ware house location selection problem for an electricity distribution company by using KEmeny Median Indicator Ranks Accordance (KEMIRA) approach beginning to become popular in recent times for solution of Multi criteria Decision Making (MCDM) problems. KEMIRA logically distinguishes criteria into two groups and it computes criteria importance weights by including interactions between both groups. KEMIRA considers both decision makers' preferences related to the priorities of criteria and quantitative or qualitative values of these criteria in decision making process. Decision makers can change importance weights of criteria based on Kemeny Median component representing expected criteria importance weights 'ranking and they can see the effect of this variability on rankings of alternatives. Since in ware house location selection problem, it is aimed to choose the favorable location considering different criteria and these criteria can be grouped firm related and environmental criteria it is a hot topic to benefit from advantageous of KEMIRA for this problem. In this context, oc-mp transportation cost per month, main ware houses transportation cost per month, number of connected oc-mp, population, distance to the closest main road, average distance to main supplier, mobility, number of oc-mp connected, consumption amounts of oc-mp, investment amounts of 2018, average delivery time and land cost are considered for 20 numbers of alternative ware house locations.

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**Keywords: KEMIRA, ware house, location selection, electricity distribution, MCDM**

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## **Forecasting Hourly Solar Power Generation Using Machine Learning Algorithms**

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Solar power is one of the most invested renewable energy source. Solar power highly depends on the external factors such as position of the sun, aerosol optical depth and especially weather conditions. These factors cause fluctuations on the power generations that results imbalances in energy markets, thus precision of the forecast effects the electricity market players invaluablely. This work entails forecasting solar power generation using machine learning algorithms per power plant per hour. For better accuracy, power plants are clustered according to their location, capacity and efficiencies using “partition around medoids” algorithm and each cluster is trained separately. Weather condition forecasts and extra-terrestrial solar radiation is gathered for any given coordinate. Radiations through day of the year and hour of the day are used to cover high percentage of the variance on power generation by delivering the information of sun’s location to the model. “Gradient boosting machines” and “artificial neural networks” algorithms are trained for more than 200 scenarios with different model arguments, and 20 different features and train-test data. Different accuracy metrics on test data are used choose the best fitting models among different scenarios. The solution is generic and can be implemented for any number of plants and anywhere on the Earth.

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**Keywords: solar power, energy, machine learning, forecasting**

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## **Wind Farm Layout Optimization: A Case of Adding New Turbine in a Farm**

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Technological developments in wind energy have reduced investment and operating costs. For this reason, wind farms have become more popular all around the world. Wind Farm Layout Optimization is one of the important investment problems to gain more energy in a single site. On the other hand, in some cases, investors may want to expend their wind turbine assessment in the same wind farm. This paper presents an optimum decision when new wind turbines are needed to be installed in a current wind farm. Due to the complex nature of Wind Farm Layout Optimization Problem, metaheuristics are used. This study does not only present an optimum layout for a given number of turbines, but it also a strategic decision by checking the economic analysis of location of new turbine/turbines in a current wind farm. Therefore, the solution is not for only a Wind Farm Layout Optimization problem, but it also gives the most beneficial decision in the case of location new wind turbine investments.

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**Keywords: Wind Farm, Layout Optimization, Meta-Heuristics, Wind Energy**

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## **Application of Network Optimization Models to the Zoo of Gaziantep**

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Most of the real life systems such as electric power, water delivery, and transportation systems can be defined as physical networks. In each of these structures, the flow from one point to another, typically as efficiently as possible - that is, along a shortest route or via some minimum cost flow pattern is tried to be optimized. In a similar manner, green parks or zoos can be considered as a network system because there are a lot of visiting nodes in these places. For instance, the zoo management can face a problem which is related the minimum route from zoo entrance and exit while visiting all the points. For aforementioned and similar network problems, popular network optimization models namely, the shortest path (SP) and minimum spanning tree (MST) problems are applied to the zoo of Gaziantep, Turkey. The network of zoo consists of 39 nodes including entrance, exit, and animal cages. With applied models, the minimum route for the visitors who have a limited time and the line which interconnects every pair of are determined.

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**Keywords: Zoo, shortest path problem, minimum spanning tree, network optimization, case study**

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## **Data Envelopment Analysis-Based Machine Learning: A Study on Public Hospital Unions**

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In this study technical efficiencies of 89 Public Hospital Unions (PHUs) were examined by using Data Envelopment Analysis (DEA) and machine learning techniques by dividing them into two clusters in terms of similarities of input and output indicators. Number of beds, physicians and nurses determined as input variables and number of outpatients, inpatients and surgical operations determined as output indicators. Before performing DEA, PHUs were grouped into two clusters. It is seen that the first cluster represents PHUs which have higher population, demand and service density than the others. The difference between clusters were statistically significant in terms of all study variables ( $p < 0.001$ ). After clustering, DEA was performed for general and for two clusters separately. It was found that 11% of PHUs were efficient in general, additionally 21% and 17% of them were efficient for the first and second clusters respectively. It is seen that PHUs, which are representing urban parts of the country and have higher population and service density, are more efficient than others. Random Forest decision tree graph shows that number of inpatients is a determinative factor of efficiency of PHUs, which is a measure of service density.

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**Keywords: Data envelopment analysis, machine learning, Public Hospital Unions**

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## **Hyperparameter Optimization for Machine Learning Regression Methods to Predict Health Expenditure per Capita**

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Data for health expenditure is usually have a heavily skewed distribution that make its use in economic analysis difficult. Machine learning regression methods are popular because of their ease of implementation and efficiency of computation. This study intents to compare the prediction performances of machine learning regression methods by hyperparameter tuning to predict health expenditure per capita. Performance results of Lasso Regression, Random Forest Regression and Support Vector Machine Regression recorded when different hyperparameters are assigned in a multiple regression model. Lambda ( $\lambda$ ), number of trees (NT) and epsilon ( $\epsilon$ ) values are assigned as hyperparameters for Lasso, Random Forest and Support Vector Regression models, respectively. The study results highlight that, the difference between machine learning regression methods prediction performances, gathered by hyperparameter tuning, are statistically significant ( $p < 0.001$ ) and Random Forest Regression ( $R^2 > 0.7500$ ,  $RMSE \leq 0.6000$ ,  $MAE \leq 0.4000$ ) is superior to others.

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**Keywords: Hyperparameter optimization, Lasso Regression, Random Forest Regression, Support Vector Regression, Hyperparameter Tuning**

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## **Utilization of Random Forest Regression Model in Complementary Health Insurance Market Design**

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In this study, a Random Forest regression model is utilized to examine the number of complementary health insured in Turkey. Data gathered from Insurance Association of Turkey, Social Security Institution and Turkish Statistical Institute statistics from 2007 to 2017 for every months of the year. A multiple regression model was conducted by using number of prescriptions, hospital admissions, average cost per prescription and value of exports determined as proxies. The natural logarithm of the variables of skewed distribution were entered into a Random Forest regression model while growing 100 trees and determining 20-folds in cross validation. Study results revealed that Random Forest regression perform well ( $R^2=0.89$ ;  $RMSE=0.25$ ;  $MSE=0.06$ ) and number of hospital admissions is the most important predictor of number of complementary health insured. It is seen that Random Forest regression will be useful for complementary health insurance market design.

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**Keywords: Complementary health insurance, Random Forest regression, Turkey**

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**An Assessment Model Study for Lean and Agile (Leagile) Index by  
Using Fuzzy AHP**

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Lean and agile supply chains are the most important and valid supply chain strategies that are accepted in today's World. They can be used separately or together in business processes. The head of the issues, which companies seek, an answer is that the companies cannot detect what extend these used strategies adept their processes. In this sense, there is not available an evaluation system which was accepted and applied by everyone in industry.

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**Keywords: Agility, Leagile Index**

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## **Analysis of Consumer Bank Selection Decisions**

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The role and importance of financial institutions in economics is increasing every year. In today's intense competitive environment, the situation is no different in financial markets. Hence banks must develop customer-oriented strategies to survive in these competitive conditions. Together with the whole world Turkey also experienced liberalization and deregulations in financial industry so many domestic and foreign banks can be chosen by Turkish consumers. Long-term relationships with customers in modern marketing approach are considered as the most important strategy. Many studies have shown that customer loyalty and retention are directly related to the profitability of the banks. Liberalization and the use of new technologies in the financial sector have also affected consumer behavior towards financial services. Consumers have become more inclined to seek alternatives and to switch banks with more options. Therefore, while bank managers are developing marketing strategies it is necessary to analyze consumers' behavior for the bank selection criteria. This study aims to propose a multi-criteria decision-making approach that will prioritize the determinants of consumer selection of retail banks. To this end, an approach is proposed based on analytic hierarchy process (AHP) and fuzzy AHP. The criteria were defined based on literature review and remarks of bank executives and academics. The weights of criteria are calculated through the AHP and fuzzy AHP approach to prioritize the determinants. Finally, an example is used to illustrate the proposed approach. The results obtained in the numerical example only reflect the situation of banking sector in Turkey.

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**Keywords: Bank Marketing, Consumer Behavior, Multi-Criteria Decision-Making**

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## **An Integrated Framework for Sustainable Supplier Selection: A Case Study in the Food Industry**

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In recent years, the concept of sustainable supplier selection has become a very important issue in the national and international arena. Firms are constantly working on sustainability issues and trying to apply this concept in production lines to provide a host of business benefits. MCDM (multi-criteria decision-making) methods provide strong decision making to determine which factors are preferred by firms in order to make this selection more objective. What is the importance of selection of sustainable suppliers and what does it mean? Firms have a lot of suppliers and can confront a lot of problems when they supply each of products. Since each of these products is procured from different suppliers, these procurement processes need to be performed with perfect and minimal cost. Firms generally choose suppliers based on criteria such as cost on time delivery, and benefit when making this selection. Supplier selection play an important role in addressing sustainable development concern. For this reason, in this study, we establish a framework with MCDM methods for sustainable supplier selection and evaluation. We aimed to analyze which criteria determine the supplier selection of the firm in the food sector. Once these criteria have been established, a hierarchical structure is formed that is divided into groups according to these criteria. After the hierarchical structure has been established, the application of AHP-TOPSIS and AHP-VIKOR methods are applied. In the first step, the AHP method is applied used to determine the importance levels of the criteria. Then, the importance levels obtained by the AHP method is used together with TOPSIS and VIKOR methods to obtain supplier orders. Finally the results are compared each other.

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**Keywords: Sustainable Supplier Selection, Vikor, Topsis, Multi-Criteria Decision Making**

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## Assessment of Digitalization Efficiency of EU Countries by Data Envelopment Analysis

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Digitalization is leading to radical changes all over the world. New technologies introduced along with digitalization, provide a continuous change and improvement in the use of resources. To adapt to these changes, it is necessary to increase the digital activities of individuals, companies and countries. Specially, European Union (EU) countries are taking important steps about digitalization. Political and industry leaders work together for digitizing industry. That is why the EU Commission set up the European Platform of National Initiatives.

In this study, efficiency levels of digitalization of EU member states are measured with Data Envelopment Analysis. Four inputs and four outputs are used to represent the digitalization efficiency of the countries. The analysis is made with output oriented CCR and BCC models. In the models, 2017 data of countries are used and solved with EMS software and results are interpreted. Thus the digitalization efficiency rating of the EU countries is determined and aims to reach the basic reasons of inefficiency in relative countries. Also target values are identified in the input-output factors in inefficient countries.

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**Keywords: Digitalization, Data Envelopment Analysis, Efficiency**

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## Shift Scheduling by 0-1 Integer Programming Model in the Natural Gas Combined Cycle Power Plants

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Shift Scheduling Problems (SSP) are the sophisticated NP-hard problems and these are solved by integer programming frequently because of its advantages in many shifts and a large number of employees of many workers. Many different models for SSP are developed and solved in the literature. However, SSP-related studies for power plants or energy related problems are still lacking, despite these facilities/problems affect the social and commercial life directly. This study presents an applicable shift schedule of workers in one of the large-scale Natural Gas Combined Cycle Power Plants (NGCCPP) which realize the 35,1% of the total electricity generation in Turkey. Proposed 0-1 integer programming (IP) model focused the balanced assignment results based on the workers' complaints and power plant downtimes due to the unfair working orders. This study includes 35 workers who work on three shifts in the selected NGCCPP for 28 days. The SSP-IP model considers the workers' everyday preferences as their main feature, bringing high performance to the highest level, bringing objective functionality and minimizing the low success of everyday choice. The model also introduced new rigid and soft constraints that reflect the nature of these workers' shift requirements by determining the optimal program. While the model was being created, the skills of the employees were taking into consideration. While the model is based on competency, Analytical Network Process (ANP) which is frequently encountered in the literature and which is a multi-criteria decision making method is used. The necessary data are obtained from the selected NGCCPP and the model solutions are validated by the power plant experts. The SSP-IP model is solved by ILOG Optimization Tool at reasonable time. The monthly acquisition time is significantly reduced, when comparing the existing manual program and the schedule obtained by solution of the proposed model. Furthermore, satisfaction of the workers is increased significantly by using the obtained schedule too.

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**Keywords: Shift Scheduling, 0-1 Integer Programming, Natural Gas Combined Cycle Power Plant, ANP**

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## **A Linear Programming Approach to Optimize Poultry Farm Operations**

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Poultry has a big importance in the share of consumed meat at worldwide. Final statistics show that 118.081 thousand tons of poultry is consumed around the world in 2017 according to OECD data. Also, poultry meat consumption per capital ratio is higher than beef and veal, pork and sheep meat for many countries. The main reasons of consumption poultry are those they are high nutritional value food, easy accessible and affordable price. In the Turkey case, poultry meat is the most consumed meat type comparing with beef and veal, sheep and pork meat. In this study, a production planning optimization problem is presented for a real poultry farm in Turkey. The cost of breeding poultry is directly related with the slaughtering day because the consumption of forage, water, medicine and electric depend that how many days chickens live. According to specific requests of company's managerial board, a linear programming approach is used to find the optimum slaughtering day with minimum cost. The objective function created by the cost of daily consumption of forage, water, medicine, and electricity. The constraints of the Linear Model are the time interval between first and second slaughtering days, the minimum breeding time up to first slaughtering, a determined maximum number of forecasted chicken death according a predefined rate, and the average age of the chickens that is slaughtered in first and second slaughtering day. The results give the optimum age for the first slaughtering as 39 day and second slaughtering as 43 day with a minimum operating cost of poultry farm. The solution of the problem can also be used for scheduling to satisfy the poultry demand.

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**Keywords: Poultry Farm, Linear Modelling, Production Planning**

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## **A New Formulation for Single Machine Order Acceptance and Scheduling Problems with Sequence-Dependent Setup Times**

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In make-to-order production environments, firms may not be able to meet all demand in a given period due to limited capacity. Accepting all orders may cause overloads, accordingly delays of some orders and customer dissatisfaction. Therefore, firms tend to select orders efficiently. Order acceptance and scheduling problem consists of simultaneously deciding which orders to be selected and how to schedule these selected orders. This problem was introduced by Oğuz et al. in 2010 and a mathematical formulation is presented. They defined the problem with sequence-dependent setup times and release dates which are closely related with setup times. In this paper, we consider the case where there are no release dates for all jobs. We develop a new mathematical formulation with  $O(n^2)$  binary variables and  $O(n^2)$  constraints and conduct a detailed computational analysis with CPLEX 12.4 by solving benchmark instances proposed by Oğuz et al. (2010). Reduced formulation of Oğuz et al. (2010) can solve the test problems optimally up to 10 jobs in given time limit. Our proposed formulation can solve all the problems optimally up to 100 jobs within the same time limit. We observe that our formulation is extremely faster than the existing one and can solve small and moderate size real life problems optimally.

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**Keywords: Order Acceptance and Scheduling, Mathematical Formulation, Order Rejection, Sequence-Dependent Setup Time**

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## **Investigating Efficiency of Major Airports in Turkey Using Data Envelopment Analysis**

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The increment in the number of airline firms as well as the comfort and time-saving in air transport made airport business more popular. Because of that the resources are limited in developing countries such as Turkey, effective operation of airports is very important, as airports have to be operated effectively so as to make it an effective business. In this paper, airports in Turkey are investigated by using Data Envelopment Analysis (DEA) methodology and they are ranked according to their cross efficiency evaluation scores. 19 airports which have annual 780.000 and above passenger capacity are chosen as major airports among 56 airports in Turkey. The data is belongs to year 2016. Total area of airport, number of runways, and number of personal are taken as input variables, flight traffic, total load and numbers of passengers are taken as output variables.

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**Keywords: Airports, Data Envelopment Analysis, Efficiency, Cross Efficiency Evaluation**

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**The Effects of Industry 4.0 on Work Safety: A Review and Future  
Research Directions**

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Industry 4.0 is the current trend that may have the potential to affect entire industries by transforming how the products are designed, manufactured and distributed. The Internet of Things, Robotics, Blockchain, Cloud Computing, Big Data, Artificial Intelligence, remote sensing, monitoring and process control, additive manufacturing, autonomous equipment and interconnectivity are becoming major tools in modern supply chains. As Industry 4.0 becomes the prominent concept, it will engender an impact on the management of occupational health and safety (OHS). On the other hand, based on the literature, we argue that current state of the art still lacks research with respect to how the “Fourth Industrial Revolution” is going to affect work safety in industry 4.0-based supply chains. The main goal of this research, therefore, is to advance our knowledge of Industry 4.0 applications and its possible affects on OHS. In this regard, the contribution of this study is twofold: first, it demonstrates how Industry 4.0 can transform OHS activities in current industry 4.0-based supply chains. Secondly, it demonstrates future research questions and opportunities based on the analysis of the current state of the art.

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**Keywords: INDUSTRY 4.0, WORK SAFETY, RESEARCH OPPURTUNITIES**

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## **Structuring Decision Making Problems for Mobile Games: A Systematical Overview**

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The mobile gaming industry has been continuously developing and renewing itself due to technological developments in recent years and in financial sense, its market share is gradually growing. Recently, mobile games became widespread compared to computer games, and it is foreseen that they will be highly profitable in the near future. This situation creates a competitive environment between the companies in gaming sector. The main objective of mobile game companies is to make the maximum profit by establishing the maximum satisfaction to the gamers. According to the academic researches, gamers can have different motivation to play a game. In real life, mostly, the mobile games are not designed for personalized preferences therefore some of the gamers do not enjoy the game. For this reason, the decision maker should be determined decision variables considering the individual features of the gamer to obtain more profit from each gamer. In this study, we emphasize the economic strategies of the mobile game companies, the psychological factors of the gamers and for different types of players how the software structure of the game should be designed. These decision making problems are related with pricing the in-game products and determining the hardness level of the game.

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**Keywords: Mobile Games, Problem Structuring, Decision Making Problems**

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## Forecasting of Autism Spectrum Disorder Using Individual and Ensemble Machine Learning Techniques

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Autism spectrum is a neurobiological disorder that is innate and admitted to be caused by different structure or function of the brain and nervous system. This disorder is a disease that affects both the patient and his relatives both materially and spiritually. Treatment costs of the disease is increasing day by day. Diagnosis of autism is based on evaluation of clinical symptoms and can emergence delayed diagnosis even in developing countries. However, early diagnosis greatly reduces treatment costs. Unfortunately, treatment costs for patients who are not early diagnosed is well above the average level that a family can afford. This has led to the emergence of a new field of study in the literature as a means of early diagnosis of autism spectrum disorder. In this study, machine learning techniques is used for forecasting of autism spectrum disorder. Machine learning techniques have three functions as classification, clustering and association analysis. This study benefits from classification function of machine learning techniques. Individual machine learning techniques include Artificial Neural Network (ANN), Support Vector Machines (SVM) and ensemble machine learning techniques include Stacking and Voting are used for forecasting of the disorder. Prepared dataset for adolescent is used. The performances of individual and ensemble machine learning techniques are evaluated considering various performance indicators such as correct classification percentage, kappa statistic, and mean absolute error. In consequence of this study, it was determined that machine-learning techniques gave 100% good results in the forecasting of autism spectrum disorder.

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**Keywords: Autism spectrum disorder, voting, stacking, support vector machine, artificial neural network**

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## **Risk Assessment with Monte Carlo Simulation Method in a Hospital Construction**

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Risk assessment and hazard identification are important concepts that must be addressed in the field of occupational health and safety. The purpose of this study is to determine the hazards that may arise in the construction of a hospital and assess the risks that may be encountered in terms of occupational health and safety. In order to achieve this purpose, any potential damage or damage that may occur during the construction of the hospital or that may affect the worker or the workplace may be observed and assessed using the Monte Carlo simulation method. These findings obtained by Monte Carlo method will be discussed. Future hospital construction will be accompanied by proposals that could prevent hazards that may arise in terms of occupational health and safety.

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**Keywords: Risk assessment, Monte Carlo Simulation Method, Hazard**

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**A Green Vendor Managed Inventory of Multi-Item Multi-Retailer  
EPQ Model under Fuzzy Environment with Stochastic Constraints: A  
Geometric Programming Approach**

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The purpose of this paper is to develop a multi-item multi-constraint EPQ model with shortage in the form of backorder for a single-vendor multi-retailer supply chain under vendor managed inventory (VMI) policy. Due to the rising concern in environmental conservation, green supply chain is considered in this paper. To include an extended applicability in real-world situations, three constraints are assumed in stochastic form. In addition, demands are considered imprecise. Since the model is developed in multi-product form, for the vendor's fixed ordering cost different conditions are considered. Geometric programming (GP) approach is employed to find the optimal solution of the model with the objective of minimizing the total cost of the system. Since the model contains signomial terms, an algorithm is utilized to convert the model into the standard form of GP. To evaluate the performance of the model and the solving method, computational experiments are presented.

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**Keywords: Supply chain, Vendor managed inventory (VMI), Economic Production Quantity (EPQ), Backorder, Greenhouse Gas (GHG) Emission, Geometric programming (GP)**

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## **A Green Mathematical Model for a Single-Machine Scheduling Problem with Batch Delivery System**

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This paper aims to minimize the total tardiness and the sum of delivery costs of a single machine problem when jobs are delivered to customers in various size batches. In the real world, this issue may happen within a supply chain in which submitting jobs to customers entails costs. On the one hand, to avoid delay costs manufacturers should deliver jobs to customers immediately after their completion, which leads to more number of transportation. Consequently, delivery costs related to the cost of vehicles traffic and their CO<sub>2</sub> gas emissions increase. On the other hand, manufacturers should submit jobs in batches to reduce delivery costs and make the green supply chain. However, dispatching several jobs in the form of batches can have a negative effect on other scheduling-related objective functions such as minimizing the total tardiness. We present a mixed-integer linear programming (MILP) model to provide a trade-off between the total tardiness and the total delivery cost. As this is an MILP model, the commercial solver (CPLEX) is not guaranteed to find the optimal solution for large-size problems in a reasonable amount of time. Therefore, we present a genetic algorithm to solve the problem.

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**Keywords:** Scheduling, Single machine, Tardiness, Batch delivery system, Green supply chain

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## **Contribution of Industry 4.0 (4th Industrial Revolution) to the Digital Games Industry**

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The 4th Industrial Revolution, also known as Industry 4.0 (I.4.0), which first appeared in industrial environments, is increasingly present in all sectors of the economy, encompassing not only organizational environments but also technological, economic and social systems. As it should be, I.4.0 has been a major contributor to the digital gaming industry (IJD), bringing significant growth, with a growing share of the economy. This article aims to identify the new I.4.0 technologies that are contributing to the IJD. The methodology used for the development of the article was an exploratory bibliographical research, in order to identify the main concepts involved in I.4.0 that are being used in IJD. The study indicated that the principles, tools and techniques (PFTs) of I.4.0 have contributed strongly to the IJD, since PFTs have a strong synergy with this segment, making it grow significantly, allowing greater segmentation, new business opportunities; with disruptive technologies further strengthens its diversification with the emergence of new techniques, equipment and approach for IJD.

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**Keywords: Industry 4.0, Digital Games Industry, New Technologies, Disruptive Technologies**

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## **Historical Perspective of the Industrial Revolutions: How We Got Here - Industry 4.0**

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This chapter focus on conceptual analysis of conjoint strategy related to industrial revolutions and what were the factors - social, technological, etc., that characterized them and which matched us until the 4th Industrial Revolution. In order to better understand “Industry 4.0” analysis and guidelines for future research perspectives, we carried out a review of literature. This chapter has synthesized and categorized the industrial revolutions in order to identify the definition evolution, development and the degree of involvement to the term “Industry 4.0”, in other production areas. We observed that the term "Industry 4.0" is a much broader concept than originally thought. These trends (Industry 4.0) are not to be compared simply with a greater level of production automation, a process that has, since the last decade, been driven by developments in electronics and information technology. The widespread adoption by manufacturing industry around the world of information and communications technology is now paving the way for disruptive approaches to development, production, logistics chain and enterprise, and all kind of communication, as machine to machine (m2m), machine to human (m2h), human to human (h2h), and new business opportunities.

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**Keywords: Industrial Revolution, Industry 4.0, Historical perspective**

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## Qualities of Mobile Health Care in China Based on Semantic Technology

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As the representative of "Internet plus health care", the Chinese government has put mobile health care as one of the important means of the supply-side reform of medical services, which is used to overcome two major problems of "difficult and expensive access to medical services". Because mobile health care allows patients to share their views and experience of medical treatment online, a large number of patient comments will be generated, which can be used to analyze patients' needs and satisfaction for doctors' services.

So, 1,028,363 patient reviews had been extracted from one of the Chinese mobile medical service websites, "good doctor online" (<http://www.haodf.com>), to analyze the patient's core needs with semantic technology techniques. The studying results, on one hand, showed that patients' core needs can be categorized into five topics needs (medical ethics, professional skills, therapy, attitude and illness) and two emotional needs (doctors' patience and seriousness).

Furthermore, significant tests were conducted based on doctors' rating grade, which was evaluated by patients online, to analyze the services' differences among doctors according to these core needs. The analytical results showed that, in generally, patients felt being satisfied by services of doctors at all rating levels, while the satisfaction degree for doctors with high rating was higher than that for low rating doctors. Although highly rated doctors satisfied most patients' core needs, the satisfaction was lower on "attitude" compared with low-rated doctors instead.

In conclusion, the paper believes that mobile health care services in China have a high quality level and patients' satisfaction. Doctor's rank online is more influenced by technical index such as professional skills and competence. Highly rated doctors show obvious advantages in professional skills, however, low-rated doctors, perhaps limited by their technical skills, are more focused on non-technical service elements such as "attitudes".

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**Keywords: Mobile health Care, Service quality, Patient satisfaction, Semantic technology**

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## **Blockchain Based Supply Chain Systems: A Review and Future Research Directions**

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The blockchain as an innovative technology has emerged as a new paradigm of the various sectors. Today, many companies, regardless of their location in developed or undeveloped countries, are being built to employ blockchain to create better efficiencies via sharing data more accessible and secure on the distributed digital networks. They are also looking for ways to adapt their companies to this rapid change. Blockchain technology also can be used as an efficiency tool in supply chain systems to monitor and manage entire chain. The concept of blockchain has recently become more popular because integrating blockchain into supply chain systems allows organizations to develop, manufacture and deliver products with increased efficiencies. The main purpose of this study is to expand our understanding of blockchain applications and practices in supply chain systems. Therefore, it provides an overview of the blockchain technology and its potential to improve supply chains. In this regard, the contribution of this study is twofold: first, it demonstrates how blockchain can streamline supply chain activities by transforming the traditional supply chains into the ones with higher digital capabilities. Secondly, it presents future research directions based on the literature review.

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**Keywords: blockchain, supply chain system, literature review**

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## **Industry 4.0 in Higher Education: Core Elements and Future Research Directions**

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Many technological developments have assisted the realization of the industrial revolutions. Over the last few years, the fourth industrial revolution has attracted more and more attentions all around the world. Concepts such as the Virtual and Augmented Reality, Internet of Things, Cloud Systems are drivers of the so-called fourth industrial revolution, which is commonly referred to as Industry 4.0. Similar to industrial applications, these concepts have been playing a leading role in the educational activities. To the best of our knowledge, however, in the current literature, there is still a lack of effort to systematically review the relationships between this new industrial revolution and higher education. Therefore, the aim of this study is to address this gap by investigating the academic progress. historically. In this regard, a systematic literature review is carried out to analyze the academic articles about the Industry 4.0 in the context of higher education. The results of this study summarize the current Industry 4.0 applications in higher education and also indicate existing deficiencies and potential research directions through proposing a research agenda. Findings of this review can also be used as a basis for future research about the effects of Industry 4.0 on higher education.

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**Keywords: industry 4.0, higher education, literature review**

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## **Determining the Suitable Information Technologies in Logistics Firms by Fuzzy Multi Criteria Decision Making Method**

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Choosing the right information technology and its successful operation are important in terms of sustainable competition and cost minimization. Progress in software and hardware technologies has contributed to the logistics sector firms reaching the data very quickly and minimizing decision making time, as in other industries. The main purpose of this study is to determine the best information technologies in 3PL firms. The application process is performed by a multi-criteria decision making model. This model includes both alternatives (Big Data, Cloud Computing, Internet of Things, Augmented Reality, Artificial Intelligence and Auto Identification/ Data Capturing, Barcode, Radio Frequency Identification) and criteria (flexibility capability, cost savings, design capability, quick response capability, real time and intervention systems capability, controllable systems capability, capable of monitoring the environmental factors). It determines the weights of the criteria by Fuzzy Analytical Network Process (ANP) and ranks the alternatives by TOPSIS. This analysis process is carried out by an expert group includes three academicians and four 3PL practitioners.

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**Keywords: information technologies, logistics, anp, topsis**

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**Performance Improvement of Information System of a Banking System  
Based on Integrated Resilience Engineering Principles**

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Integrated resilience engineering (IRE) is capable of returning banking systems to the normal state in extensive economic circumstances. In this study, information system of a large bank (with several branches) is assessed and optimized under severe economic conditions. Data envelopment analysis (DEA) models are employed to achieve the objective of this study. Nine IRE factors are considered to be the outputs and a dummy variable is defined as the input of the DEA models. A standard questionnaire is designed and distributed among executive managers to be considered as the decision-making units (DMUs). Reliability and validity of the questionnaire is examined based on Cronbach's alpha and t-test. The most appropriate DEA model is determined based on average efficiency and normality test. It is shown that the proposed integrated design provides higher efficiency than conventional resilience engineering design. Results of sensitivity and perturbation analysis indicate that self-organization, fault tolerance and reporting culture respectively compose about 50 percent of total weight.

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**Keywords: Banking System, Data Envelopment Analysis (DEA), Integrated Resilience Engineering (IRE), Performance Evaluation, Perturbation Analysis**

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## **An Application of Blockchain Systems in Livestock Supply Chain Management**

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The rise of peer-to-peer platforms has advanced for commercial interactions among private individuals and corporations on large scale. In recent years, technology startups have increased the potential of higher resource utilization within the sharing economy. By considering all these concepts, a blockchain can be defined as a database that is shared among its utilizers and allows them to share valuable assets in a public and pseudonymous setup without the reliance on a central authority. Livestock supply chain management studies are generally examining and solving of problems that are in the topic of manufacturing process for centralized distribution concept. In this study, the situation of applying blockchain systems in livestock supply chain management are investigated due to the parameters of security, exchange tools, utilization rates, transactions from the perspectives of consumers and providers. An optimal solution has been a clear objective in the process of finding out what have to be done for decentralized distribution concept of blockchain systems. A framework have been put for understanding the general structure and agent based simulation is utilized for demonstrating the supply chain and effects of parameters within the supply chain.

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**Keywords: Livestock Supply Chain Management, Blockchain Systems, Agent Based Simulation, Scenario and Experimental Analysis**

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## **Solution of Multi-Objective Optimization Model in FMS Design with Scalarization Methods**

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Multi-objective optimization problems are more encountered in real life than single-objective optimization problems. Therefore, the solution of this multi-objective optimization problems has a critical importance due to its contribution to many areas. The objective function of operation allocation and material handling system selection in Flexible Manufacturing System (FMS) in the literature are created to minimize the costs related to the manufacturing operations, machines set up and material handling operations and to maximize the compatibility of the part types and the material handling equipment assigned to handle parts. The solutions of this problem can be achieved by multi-objective optimization solution techniques because of conflicting structure of the objective functions of this problem. Scalarization methods are used for solving multi-objective optimization problems. Scalarization is the transformation of multiple objective functions into a single function that can represent all of them. 6 scalarization techniques were applied on this model and result were compared within this study.

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**Keywords: Flexible Manufacturing System, Multi Objective Optimization, Scalarization Techniques**

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## **Determining the Position of Countries according to the Quality of Life Index Criteria**

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The expectation of human being from everyday life is augmenting day by day with the evolving technology. These circumstances induce a significant increment in the number of studies carried out on the quality of life each day. The purpose of this study is to clusters countries according to the quality of life criteria. It is a complex indicator that is influenced by a high amount of criteria. Due to the fact that, the quality of life studies can be examined in the topic of multidimensional subjects. Plenty of the studies have been conducted wielding various criteria that affect quality of life. In this study, countries were clustered by viewing eight distinct indices which were formed by putting account different criteria used in many studies about quality of life and which affect this concept. It has been aimed in order to determine criteria which affect the life quality in countries and to identify similarities and dissimilarities of countries according to these criteria used to evaluate the quality of life. As a result, it has been determined that geographical location and cooperation between countries are generally effective on the clusters according to selected indicators.

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**Keywords: Quality of Life Index, Clustering, k-means**

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## Interval-Valued Pythagorean Fuzzy Hypotheses Testing: An Application

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The differences between reality and theoretical prediction lead to the fact that classical statistical hypotheses are often lacking in real life applications. This deficiency has been tried to be solved by applying fuzzy set theory in hypothesis tests. The fuzzy set theory is used in cases of uncertainty in hypotheses. The researchers extended the classical fuzzy sets to a number of different fuzzy sets such as interval valued (IVFSs), intuitionistic (IFSs), interval-valued intuitionistic (IVIFSs), and hesitant fuzzy sets (HFSs). It has become advantageous to use intuitionistic or Pythagorean fuzzy sets in hypothesis tests because of the flexibility they provide. However, in spite of numerous researches on statistical test with imprecise hypotheses, no study has been conducted on statistical test based on Interval Valued Pythagorean Fuzzy (IVPF) hypotheses. In this study, two different methods, which calculate the mean of IVPF numbers with distinct ways, for IVPF hypothesis testing have been proposed. A data set consisting of IVPF numbers have been handled and proposed hypotheses test on  $\mu$  are performed on this dataset. The results obtained have been compared with each other and the findings have been found to be similar.

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**Keywords: Fuzzy Hypotheses Testing, Interval-Valued Pythagorean Fuzzy (IVPF) Sets, Interval-Valued Pythagorean Fuzzy (IVPF) Hypotheses Testing**

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**Determination of Cities' Economic Efficiencies by Using Malmquist  
TFP: The Case of Turkey**

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It is important to determine the economic efficiencies of cities for the reasons such as determining investments to be made and planning of city development. Detailed researches and analysis should be carried out to determine the economic efficiencies of cities.

In this study Turkey's cities were clustered according to economic activity areas which were determined by Republic of Turkey Social Security Institution. After that clustering, for the cities in the same cluster, cities' efficiency changes over time were measured by a model that utilizes the Malmquist Total Factor Productivity Index. For this purpose number of investment incentive certificate, number of work place, number of tradesmen, number of insured workers were used as inputs and gross domestic product amount, export amount were used as outputs.

This study shows cities that use their economic resources efficiently and those who cannot use them efficiently. With this viewpoint this study provides some useful information for cities' chambers of commerce and industry and decision makers who work on urban development planning.

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**Keywords: Urban Development Planning; DEA, Malmquist TFP, Clustering**

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## **Analysis of Variables Affecting University Preferences of Disabled Students by Multiple Correspondence Analysis**

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It is mandated by law to take the necessary precautions to prepare university students with disabilities to facilitate their learning and to ensure their full participation in the education and training process. For this reason, it is important not to view disability as a problem, to ensure the traceability of students with disabilities in universities, to conduct statistical surveys for them, and to record the information of students with disabilities.

The study was conducted by universities in Turkey to investigate the type of disability and gender of persons with disabilities. In order to ensure that students with disabilities can continue their education without any problems, the universities are a guide to the issues that need to be taken according to the types of disability. A Model of Multiple Correspondence Analysis was defined to examine and visualize the relationship patterns between disability type and gender variables affecting the university preferences of students with disabilities.

The Multiple Correspondence Analysis is a perceptual mapping technique that represents associations in the table of variables shown in the form of a contingency table. In these tables, the similarities and similarities between the variables are shown and graphically displayed by showing the categories of the variables as less-dimensional space points.

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**Keywords: Accessible University, Multiple Correspondence Analysis, Perceptual Mapping**

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## **The Energy Cost Comparison Using Mixed Integer Linear Programming and Simulated Annealing Method in Smart Home**

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Smart home energy scheduling problem is a significant subject in power system to avoid extra expenditure. In this work, the scheduling problem is realized using mixed integer linear (MILP) programming and simulated annealing (SA) method. MILP is one of the integer optimization method and SA is a strong technique for solving hard combinatorial optimization problems. Various types of electricity tariff is applied from country to country. In Turkey, one term and three term tariffs (electricity prices are divided into three parts; off-peak hours, mid-peak hours on-peak hours) are used. In this study, the three term tariffs are selected for the scheduling problem. There are some constraints about working principle of appliances which have own working range in smart home energy management system. It is defined that how many hours per day each device will run. Also it is defined that which hours are possible to run appliances in smart home. The advantages and disadvantages of the methods compared to each other are discussed.

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**Keywords: MILP, Simulated Annealing, Smart Home, Energy Scheduling**

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**Prioritization of Failures for Public Transport System with a Case Study in Istanbul**

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Although many papers have been carried out on behalf of the detection and investigation of the failures of the vehicles, the failures in public transport vehicles and their effects on daily life have not been sufficiently investigated. Determining the failures of the vehicles in the public transport and carry out analyses for them is crucial issue for public benefit and many reasons. In this paper, we performed a priority analysis to determine the effect of failures that are encountered in bus rapid transit system (BRT) used in Istanbul. For this aim, the most and least important failures are tried to specify by using fuzzy multi-criteria decision making (MCDM) methodology which consists analytic hierarchy process (AHP) and TOPSIS approaches under type-2 fuzzy environment. Firstly, it is determined by the information received from the institution about what the failures are and evaluations of experts in the field have been taken in order to determine the order of importance of these failures by using some linguistic scales. It is believed that this paper will be a road map for the researchers who are working in this area or the staff working for the related failures on BRT.

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**Keywords: Failures, Fuzzy Sets, MCDM, BRT, Istanbul**

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## **Historical Perspective of the Industrial Revolutions: How We Got Here - Industry 4.0**

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In order to better understand “Industry 4.0” analysis and guidelines for future research perspectives, we carried out a systematic review of literature. This literature review has synthesized and categorized in order to identify the definition, evolution, development and the degree of involvement of the term “Industry 4.0”, in other production areas. This literature review was limited to articles available using search terms restricted to: “Industry 4.0” in the title of articles, set of scientific articles (congress and publications), technical magazines (not scientific), consultancies and government publications, without restrictions regarding the years of publication, 97 articles published since 2012 constituted the sample. We carried out our review based on the results in the ISI Web of Science, Scopus, Science Direct, EBESCO, Springer, Scholar Google and Google. Research database and publications were limited to works written in Portuguese, Spanish and English. We observed that the term “Industry 4.0” is a much broader concept than originally thought. These trends (Industry 4.0, IoT, etc.) are not to be compared simply with a greater level of production automation, a process that has, since the last decade, been driven by developments in electronics and information technology. The widespread adoption by manufacturing industry around the world of information and communications technology is now paving the way for disruptive approaches to development, production, logistics chain and enterprise.

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**Keywords: Industry 4.0, Internet of Things, Internet of Services, Internet of Data, Cyber-Physical-System**

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## **Granary Location Selection by Using an Interval-Valued Intuitionistic Fuzzy AHP Method for Sustainable Agricultural Development**

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Today, due to the increase in urbanization and the decrease in population density in the rural areas simultaneously caused to degradation of agricultural lands and activities. This issue arises with the problem of effective transportation of produced products to the market and handling storage operations with least loss due to putrefaction. So, the location selection problem for granary is a critical multi criteria decision-making (MCDM) problem. These operations and their depended criteria have many uncertainties due to the lack of knowledge and qualitative data from the experts. In order to deal with the criteria and alternative locations, MCDM methods are suggested to deal with the problem in the literature. In this context, we will investigate how many criteria are relevant with the selection process, try to build a set of possible alternative construction sites, collect the appropriate information about alternatives with respect to criteria, and evaluate them. For this aim, we apply Intuitionistic Interval-Valued Fuzzy (IVIF) (AHP) method to determine the most appropriate location for the granary construction site to create a sustainable agricultural supply chain system in the Central Anatolia Region of Turkey. We apply one-at-a-time sensitivity analysis based on the criteria weights to check the robustness of the suggested approach. A comparative analysis is also conducted to verify validity of the applied method.

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**Keywords: intuitionistic fuzzy sets, multi criteria decision making, fuzzy logic, agricultural system**

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**A Two-Stage Approaches for Pricing and Capacity Decisions in the  
Healthcare Systems Based on Contract Mechanisms between the  
Government and a Private Hospital**

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In most health systems, public and private hospitals co-exist with different features such as price, waiting time and perceived quality level affecting the choice of strategic patients. In general, although the prices are cheap in public hospitals, waiting times are long since they are crowded, which reduces the perceived quality level by the strategic patients. Private hospitals have low waiting periods and high level of service quality. In these hospitals, prices are also high, which are determined through the contract mechanism with the government. Also, the capacity of these hospitals seriously affects the waiting times and quality perceptions of the strategic patients. In this study, new bi-level models are proposed to define the price and capacity of a private hospital. These models have been investigated in cases that there are contract mechanisms between the government and the private hospital based on subsidies and also financial incentives. The results are compared based on the public benefit concept. The results show that the mechanisms based on financial incentives are more favorable than those are based on subsidies.

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**Keywords: Healthcare management, Contract mechanisms, Public benefit, Pricing, Capacity**

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**The Effects of Contract Mechanisms between the Government and the Private Sector on the Public Benefit in a System with Multiple Private Hospitals**

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In this study, it is assumed that in a region there are two private hospitals with different quality levels and capacities nearby a public hospital and the patients of the region choose one of these hospitals for treatment. The benefit that each patient gets in the chosen hospital is defined based on the level of quality he/she perceives, the average waiting period and the price paid. The probability of selecting one of these hospitals by a strategic patient is defined based on the benefit that he/she receives from the selected hospital. Then, the cases in which (i) there is no contract between the government and the private hospitals, and (ii) there is a subsidy-based contract mechanism are analyzed through the private hospital's profit and the public benefit, which is defined as a multi-objective function consisting of the benefit of patients and the average expenditure of the government. The results show that the contract between the state and the private hospital is beneficial for society.

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**Keywords: Healthcare management, Contract mechanisms, Public benefit, Pricing**

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## A Comparison between Neighborhoods Structures Defined for Scheduling Problems

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In this study, firstly the neighborhood structures defined in the literature for the scheduling problems are explained. For this aim, the concepts of the disjunctive graph, critical path, and critical block are described. Based on these, the details of several moves and exchanges are expressed. In addition, the described structures are compared in terms of complexity and size. Some of the neighborhoods combined with a hybrid algorithm are used for solving the flexible job shop scheduling problem, where the initial solutions are generated randomly. The benchmarks, which are MK instances are taken from the literature. The objective function is defined as makespan. The effectiveness of the used neighborhoods is compared based on the obtained results. Then, the same algorithm is applied to the same benchmarks but the initial solutions are constructed with various heuristics from the literature. The results are compared with the cases where the initial solutions are randomly generated, and in this way, the benefit of the hybrid methods are demonstrated.

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**Keywords:** Scheduling, Disjunctive graph, Neighborhood structures, Hybrid methods

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**A New Risk Assessment Methodology by Using Pythagorean Fuzzy  
Analytic Hierarchy Process**

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The risk assessment is defined as work carried out with the aim of determining the hazards that may exist in the workplace and the measures to be taken. Several quantitative and qualitative risk assessment tools exist in the literature to analyze the characteristics of different sectors' causes of accidents and workplace conditions. The fuzzy sets have been used for more effective rating in risk assessment. In this paper, Pythagorean Fuzzy Analytic Hierarchy Process (PFAHP) method has been suggest to deal with risk assessment process with a real case study. The paper focuses on PFAHP method with cosine similarity to support facing of uncertainty in the risk evaluation process for asphalt production, asphalt laying and coating services. The risks of an asphalt production factory are assessed by the proposed method based on Pythagorean Fuzzy Sets. The results are revealed that the proposed approach produces reliable outcomes better representing the vagueness of the decision-making process. As an outcome of the analysis by the proposed method, the criterions manometer size, chemical conditions, and excessive dangerous substance are found to be most critical factors.

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**Keywords: Pythagorean Fuzzy Analytic Hierarchy Process (PFAHP), cosine similarity, risk assessment**

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## **Hub Facility Evaluation in Humanitarian Supply Chain Using MULTIMOORA**

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Every year, more than 300 disasters which are caused by many different reasons sprawling from natural to human-related, take place around the world. As a part of efforts to relieve the affected people from disasters, the humanitarian logistics are widely interested and studied by humanitarian organizations and academicians. World Food Programme (WFP) which is one of the leading organizations assisting over 80 million people each year. According to WFP, about half of goods distributed is sourced directly within the country or region where the crisis is being of, while the other half is sourced internationally and is shipped. This international response is provided by United Nations humanitarian response depots which is managed by WFP. The key elements of that network are the hubs positioned near disaster-prone areas where emergency supplies are stored. There are 6 hubs in network at present. In this study, a decision support scheme to determine suitable location candidates for next hubs if required, is proposed. A multi criteria decision making technique, MULTIMOORA, is used together with fuzzy information to examine the alternative locations according to certain criteria including immediate mobilization, cost efficiency, stability of hosting region etc.

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**Keywords: Humanitarian Logistics, MCDM, MULTIMOORA, WFP**

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## **Surgery Types Related Operating Room Scheduling and Surgical Team Assignment**

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Scheduling studies help to increase the efficiency and the amount of service provided by the institutions in the health sector. A surgical operation that cannot be performed on a timely and qualified manner can lead to loss of patient and prestige for hospitals. The use of operating rooms and surgical teams that are at the very beginning of the resources of a hospital, should be defined in an effective manner. In terms of surgical teams conducting the operations, some additional criteria should also be taken into consideration such that the working conditions should be well regulated, the workload should be adjusted appropriately, rests should be allocated and that training opportunities should be given to the junior surgeons. In this study, the problems of operating room scheduling and surgical team assignment, in which the surgical teams are formed according to the surgery types, are taken into care. A mathematical model is proposed under problem specific constraints and assumptions. The model aims to find the optimal solution for the assignment of all scheduled operations to the operating rooms and to surgical teams on a daily basis.

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**Keywords: Operating Room Scheduling, Surgical Team Assignment, Optimization, Nonlinear Integer Programming**

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## **The Development of Servitization in Operations Management and It's Effect on Production Companies, A Case Study**

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The manufacturing companies required to add services in conjunction with the products. The main cause of this product-service system transformation is that services in addition to the product (servitization) are requested by the customers. However it is a big challenge for production companies since servitization demands consideration business model and organizational changes. In this sense, servitization becomes one of the main operations stage, thus affecting costs and profitability. The servitization of manufacturing is a diverse field of academic research interest. There are eight different types of servitization: Products with limited support, Installed and supported products, Complementary services, Product-oriented solutions, Systems leasing, Operating services, Managed service solutions and Total solutions. In this study, the effect of integrating different servitization processes within the supply chain of an office-press machine and materials manufacturing company has been examined in details. Decision-making process consists of two steps. Firstly, the weight of factors affecting the choice of servitization type is determined by using AHP. Secondly, one alternatives among eight types of servitization is selected by the managers of the company using TOPSIS.

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**Keywords: Servitization, Operations management, Industrial servicing, MCDM**

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## **A Research on Factors that Bring Success and Quality in Software Development Life Cycle**

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In a rapidly growing technology world day by day, software projects are heavily needed. Software industry becomes one of the most widespread industries of developing and developed countries. Software projects does not achieve 100% success all the time. Most of them can fail because of delays or budget exceeding or change in project. Because of not being palpable, not being controlled via usual physical laws of nature and diversity of production types, many people, executive and customer still have doubts about software, even in modern-day society. Even though Software Development Life Cycle (SDLC) is needed in order to get rid of these doubts and to reach the intended success and quality level, there is an international standard. SDLC is a process that is used by software industry in order to design, develop and test the high quality software. SDLC aims to product a high quality software that meets the customer expectations, gets completed in time and catches the cost estimations.

SDLC is a process that covers all of the planning, production and usage stages of a software product. A project is completed with a 6 main steps (Planning, Analysis, Design, Develop, Implementation and Maintenance) present in SDLC. The steps can be increased or decreased depending on scope of the project. This cycle is a method that should be foreseen in developing software or any other projects. A software project can only be successful by planning these steps accurately and professionally. Analysis procedure, being one of the most important stages of software development life cycle, is one of the most influencing factor of success and quality level of a project. In this research, factors that lead to success and quality in software development life cycle and SDLC process, software development models, business analysis and business analysis techniques will be investigated.

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**Keywords: Software Projects, Software Development Life Cycle (SDLC), Business Analysis, Software Development Models**

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## **Analysis of Operating Rooms for Efficient Management**

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Operating rooms are one of the critical resources of hospitals. These units are also the most contributors to the budget of hospitals. From the point of view of the patients, a well-managed operating room means high availability and short waiting times. Hence optimizing operating room performance is a major concern of managers. Before any optimizing study can start a thorough insight in operating room characteristics is essential.

This study first presents a literature survey to investigate different performance metrics that is used to measure the performance of an operating room. Secondly, problems that encountered in management of operating rooms discussed. After discussing the working characteristics of operating rooms, at the end of the study, solutions to the problems in the literature is discussed and a performance indicator is proposed for the measurement of the performances of the operating rooms. With the proposed indicator it is aimed to make the different dimensions of the operating rooms to be quantifiable and measurable.

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**Keywords: Operating Rooms, Performance Management, System Engineering**

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**Lean Thinking Principles and an Application in Manufacturer  
Exporter Company**

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The terms of performance and productivity have a great importance for the manufacturers operating in today's intense international competition environment so as to counter this condensing rivalry. Performance and productivity are the key factors in terms of achieving effective use of available resources and competitiveness. In order to see the effectiveness of performance and productivity, making measurements, increasing the effectiveness of performance and productivity according to these measurements' results and reducing wastes are necessary. In this study; to obtain these determined aims, a system analysis was carried out in an operating international manufacturing enterprise, and value added and non-value adding steps were identified. As a result of system analysis, it is thought that the most appropriate system to be applied is the lean thinking system and the best result can be obtained with the lean thinking principles. In terms of lean thinking principles, a value stream mapping was created and it was seen more clearly how much of the processes consist of value-adding activities. Problem definitions were made by using lean manufacturing tools like value stream mapping and observations, and solutions were produced within the framework of lean manufacturing principles.

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**Keywords: Lean Thinking, Manufacture, Pareto Analysis**

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## **Branch and Bound Algorithm with New Lower Bounding Methods for U-Shaped Assembly Line Balancing Problem**

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U-shaped assembly lines draw increasing attentions from researchers and engineers due to higher flexibility and efficiency. This research employs several new lower bounding methods to enhance the performance of the branch, bound and remember algorithm (BBR) in solving U-shaped assembly line balancing problem (UALBP), which is the current state-of-the-art methodology. These newly applied lower bounding methods include the well-known LB6 and a set of bounds derived from the dual feasible function. The sequence of utilizing these lower bounding methods and dominance rules is also investigated to achieve the proper balance between speed and solution quality. Computational results show that these new lower bounding methods achieve tighter lower bounds with the cost of increased computation time. Comparative study demonstrates the superiority of the new BBR method with these new lower bounding method, and this new BBR method is also capable of achieving some new upper bounds.

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**Keywords: Assembly line balancing; U-shaped assembly line; branch and bound; Lower bounds**

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## **A Dragonfly Algorithm to Job Shop Scheduling Problem with Assembly Operations**

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In this paper, a job shop scheduling problem with assembly stage is considered. Considering production and assembly stage simultaneously deserves a high attention due to the instances of real world and the problems which may be caused by ignoring the interactions between production and assembly stage. So this paper aims to solve job shop scheduling problem with assembly stage. A large variety of approaches including metaheuristics have been implemented to solve this problem and the results indicate that hybrid genetic and parallel simulated annealing algorithm (HGAPSA) and the hybrid genetic and parallel variable neighborhood search algorithm (HGAPVNS) perform better than the other proposed algorithms with respect to the objective function which is minimizing the maximum completion time of jobs. As job shop scheduling problem with assembly operations is confirmed to be NP-hard, a metaheuristic algorithm (dragonfly algorithm) is implemented to solve this problem. Dragonfly algorithm is a population-based algorithm with two swarm behaviors indicating exploration and exploitation phases of optimization. It updates the swarm factors using five primitive principles. The results are computed and compared with benchmark methods.

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**Keywords: Job shop Scheduling, Assembly, Dragonfly algorithm**

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**A Multi-Period and Multi-Product Model with Different PM Level  
Based on Scenario**

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In our production system, a set of different products are produced. In this system, two types of failures are probable. Failure type I is the situation when the system shifts from in-controlled to out-of-control and a percentage of products goes out of standard, this type of failure is determined by inspection. In each inspection, preventive maintenance is carried out if necessary. Preventive maintenance with different levels for reducing the age of production system has different cost and time. Failure type II is the situation when the system goes out of reach and production is stopped. In failure type II, incomplete maintenance and, at the end of each period, complete maintenance are carried out. Both failures have a general probability distribution. In this model, lost demand is allowed and the value of demand and lost order will be different according to different scenarios. This difference in these values in each scenario will make a difference in the number and the level of PM and the number of type I and II failures. This model is firstly solved in GAMS, and then the step-by-step counting method and meta-heuristic method are also used to solve it. The results are compared with each other.

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**Keywords: Failure, Inspection, Preventive Maintenance, Lost Order, Scenario**

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**Analysis of Patient Flow in Magnetic Resonance Imaging Department  
Using Queuing Theory Approach**

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The Magnetic Resonance Imaging department (MRID) is a paraclinic center, which provides services to patients and helps physicians to diagnose the diseases. Decreasing the patients' waiting time, and increasing the patient's satisfaction is an important problem for each MRID. We conducted a study over the period September 25 - October 25, 2017, in the MRID of a specialist hospital. In the end, we show that how queuing models can helpful to determine performance parameters of MRID and reduce waiting times.

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**Keywords: Queuing Theory, Waiting time, Healthcare**

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## **An Application for the Selection of Examination Buildings and Halls for Institutions Conducting Centralized Examinations**

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Decision of facility selection has problems which involve plenty number of criteria in evaluation processes. Abundance of criteria and the requirement of compatibility with each other, facility selection problem embrace outstanding challenges by itself. When complexity of a problem is increasing, the challenges associated with it are being even greater. In order to solve these complicated problems, very specific decision making methods have been developed as multi criteria decision making (MCDM). In this study, Analytic Hierarchy Process (AHP) method has been used to evaluate existing examination buildings and halls. AHP is one of MCDM methods considering both qualitative and quantitative factors for institutions conducting centralized examinations. To select examination buildings in provinces of Turkey, variety of criteria has been used according to human factors, ergonomics and other means. In this study, a sample of 21 examination buildings have been evaluated according to such main criteria as transportation, features of examination buildings, physical conditions of the halls, environments of the examination buildings. In this application, a programme which is written in Microsoft Excel software program has been used for evaluations. As a result of the study, the steps of AHP method have been discussed for evaluating the examination buildings and halls. A sequence of buildings and halls according to preset criteria has been obtained. The sequence can further be broken in to different lists based on different requests. This study was performed informally for an institution conducting centralized examinations throughout the country. Data and evaluations are reflecting real cases.

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**Keywords: Analytic Hierarchy Process, Facility Selection, Decision Making, Human Factors and Ergonomics**

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### **Critical Success Factors in Organizational Culture**

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The world that we live in where the social and organizational life rapid social and cultural transformations are experienced, the intensities of change and competition are intensely perceived has a dynamism. In this dynamism every human being is a part of an organization. In these organizations there is a culture which is defined in various ways by various thinkers and is a rather complex concept; however all definitions have reached the conclusion that the culture is a common entity shared with a community. In 1980s the concept of organizational culture is emerged. In the literature this concept is very debated and worked. While many formal definitions exist, organizational culture is basically a term used to describe the environment in which people work and the influence it has on how they think, act, and experience work (Warrick, Milliman, & Ferguson, 2016). Therefore, we can say that, organizational culture is expressed as a system of norms, behaviors and values, beliefs and habits that guide the behaviors of individuals in an organization, and also just as each individual is a unique personality, every organization has its own personality that distinguishes it from other organizations. Hence, organizational culture consists of several abstract and complementary factors. These factors help us to decide the more effective, successful decision. There can be many factors affects the success, what we have to do is prioritizing critical factors. This is where multi criteria decision making methods come into play. In this study, we aimed to reach which factors are more important, effective in the case study.

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**Keywords: Multi Criteria Decision Making, FAHP, Organizational Culture**

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**A Comparison between the Optimization of PID Controller for DC Motor by Using the Genetic Algorithm (GA), the Artificial Bee Colony Optimization(ABC) and Grey Wolf Optimizer(GAO)**

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The DC motor's speed has enjoyed a great deal of research and has produced many ways to improve DC engine tracking performance. Large-scale PID controllers are utilized to control the speed of a DC motor. Many methods are utilized to improve the standards of dynamic systems controllers. One of these controllers is a proportional integrated derivative controller (PID). The Dc engine is a dynamic system. In this paper, improved gains of this control and optimization of DC-motor position control were studied.

The study focuses on the comparison between the Genetic Algorithm (GA), and other optimization algorithms Artificial Bee Colony Optimization (ABC) and Grey Wolf Optimizer(GWO). Using Artificial Bee Colony (ABC) algorithm for the best PID parameters regulation DC motor control. The goal of proposed method is to improvement the performance of DC motor. Grey Wolf Optimizer Algorithm, is used and designed for DC Motor drive to find the optimum solution in search. The results of the proposed algorithms will be compared with Genetic Algorithm(GA).

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**Keywords: Genetic Algorithm, ABC,GWO, PID, DC-Motor, Tuning, Optimization**

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## A Turn-Key Project Design Using Structured Systems Engineering Techniques: Vermicomposting

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Various techniques are used to design a production project. In this study, a turnkey project is designed using Structured Systems Analysis and Design Methodologies (SSADM). The project is to produce vermicompost from *Eisenia Foetida*. With SSADM, the system is transformed into activity diagrams at three levels namely departmental level, functional level and user requirements level. Data and materials flows of the whole system are represented on the diagrams. To further the User Requirement level activities Functional Flow Breakdown Diagrams have also been created.

Today, many farmers use chemical fertilizers in agriculture. Chemical fertilizer caused many negative consequences such as a change in the pH value of the soil, decrease in water retention property, decrease in yield, increase in the probability of erosion, reduction in the retention time of fertilizer in the soil, pollution in ground waters, the decrease in productivity from soil-grown products, blocking the functioning of microorganisms in the soil and decrease in the amount of organic matters in the soil. For this reason, the use of organic fertilizer in agriculture has become very important both in terms of environmental consciousness and health. Vermicomposting is a preferred activity in the production of organic fertilizers due to such facts as can be started with relatively low budget, can be applied easily, and the resultant demand for agricultural productivity increases. The yield obtained from the *Eisenia Foetida* is higher than the other worms and these worms multiply very rapidly.

The turnkey project designed can be implemented easily and can further be adjusted according to the needs and requirements of entrepreneurs. Activity based costing and manpower planning would give great flexibility in the application. Moreover, systematization of the entire project will let fully computerization of the process if not in this one but surely in another one. From this perspective, it is also an attempt to understand Industry\_4.0 concept which is come to the fore nowadays.

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**Keywords: Organic fertilizer, Structured Systems Analysis and Design Method, systematization, activity based costing, manpower planning, Industry 4.0**

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### **Third-Party Logistics (3PL) Provider Assessment by Using Fuzzy AHP-VIKOR Approach**

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Economic contractions, new communication technologies, and new market search have forced companies more outsourcing by shifting its operations geographically to distant countries. Transferring all or part of the logistics activities to the external firm(s) can be defined as outsourcing. Some of the opportunities to add value to companies through outsourcing: supply security, cost reduction, gaining flexibility in the supply chain, shortening average order cycle times, expanding market boundaries. When it is time to select a third-party logistics (3PL) provider for a particular use, companies should carefully evaluate candidates to ensure win-win relationships. In this study, we address the issue of selection of third-party logistics (3PL) providers, taking into account the needs or requirements that match manufacturers. In this study, a framework is proposed for evaluating 3PL provider selection using an integrated multi-criteria solution approach Analytical Hierarchy Process (AHP), ViseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR). This approach has three phases: i) Determination of criteria of 3PL provider selection QFD, ii) Evaluation of the criteria weights by Fuzzy AHP, iii) Rating of 3PL providers performances against the evaluation criteria by VIKOR. This approach is conducted by a German automotive company to redesign its logistics operations and select a global logistics service provider.

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**Keywords: 3PL logistic provider, fuzzy AHP, VIKOR, Outsourcing**

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## **MCDM Techniques Utilization in Research and Application: A Critical Review and Comparisons**

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MCDM techniques and methodologies have been widely used in the literature in different applications, which vary according to the objectives of the research and desired outcomes. It is also known that MCDM methods are used for complex decision making in order to ensure that the taken decision is based on weighted criteria and alternatives. Moreover, the choice of the MCDM technique for a specific application imposes implications on the accuracy, validity and feasibility of the results. Therefore, it is essential for scientific researchers applying MCDM methods to justify their use of a specific method for specific objectives and applications. In this research, a review of three important MCDM methods is performed; AHP, DEMATEL and TOPSIS. The three methods are reviewed briefly based on their advantages and disadvantages; however, the main focus is to survey the literature for the justifications provided to use them and the implication on the results of the application. Furthermore, the three methods are compared through the different studies, as well as a critical discussion of the literature. Moreover, the last part of the research focuses on researches adopting fuzzy linguistic terms with MCDM techniques, where the impact of using this method is compared with lean MCDM methods.

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**Keywords: MCDM, AHP, DEMATEL, TOPSIS, Fuzzy**

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## **Set Covering and Maximum Covering Models for Location Selection and Resource Allocation: Case Study in Turkey**

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Set coverage models are used to minimize the location selection cost, which provides a certain level of coverage. And the maximum coverage deployment model is used to optimize the maximum demand that can be closed with available resources. Forests, one of the most important and most important natural resources to be protected, are at risk because of increasing population, industrialization, expansion of agricultural lands and climate change. The greatest danger for forests is fire risks and fires cause shrinking in forest areas. For forest fires to be overcome with minimum damage, vehicles used in forest fires need to be positioned so that they can reach the risk area as soon as possible. Also, the optimal vehicle number must be determined before positioning. In this study, we aimed to use set coverage model to determine the number of vehicles which are used in extinguishing forest fires and maximum coverage model to position them. Before using set covering model and maximum covering model, it revealed the risk of fire in forest areas in Turkey. These risks are derived from a combination of factors such as vegetation cover, climate, distance to settlement units, past forest fire statistics, and possible fires damage, and sub-factors related to these factors.

In the final stages of testing problems with verified models and solution methods of forest fire response vehicles in Turkey (land and air) it will be used to determine the number and location.

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**Keywords: Set Covering Model, Maximum Covering Model, Location Selection, Fire Management**

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**A Human Centered Multi-Criteria Decision Making Approach  
Proposition for Priorization of Ergonomic Factors in Terms of  
Working Productivity**

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Ergonomics; which is also known as human engineering science, is an interdisciplinary working area that investigates human-machine-environment consistency in the aspects of biological and psychological states of human and can be expressed as the adaptation of physical environment to human beings in short. In today's residual behavioral consciousness, it is already known that ergonomically convenience of working environment for users is getting more important for both sides of working world, since it is proved that suitable ergonomic working conditions affect employee productivity substantially positively. In this study, ergonomic factors that affect productivity are conducted with a human centered MCDM technique to reveal their real significance in the sight of users. SWARA (Step-wise Weight Assessment Ratio Analysis) is a well suited MCDM technique for problems that requires the ability of forecasting the expert opinions related to the significance ratios of evaluation criteria of the decision problem. The ergonomic factors corresponding to working productivity level of an employee are investigated and prioritized with the employment of SWARA methodology in terms of employee evaluations in our study. As results, a ranking of the ergonomic factors is provided with regards to considerations of users, and enhancement suggestions are presented to assure possible productivity increment.

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**Keywords: Ergonomic factor analysis, SWARA, Productivity, Indoor environment analysis**

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## **An Integrated Model Proposal for the Selection of Lean Manufacturing Techniques**

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To survive in harsh competitive environment, In addition to the efficient use of production resources, it is also important to reduce the wastes by identifying the reasons of wastes within the enterprise. The wastes that may be encountered in the lean manufacturing philosophy are collected under the heading of 7 wastes and are called 7 Muda (overproduction, stock, inter-process movements, waiting, excessive processing, human errors, in-process movements). In this study, a model proposal was introduced for an enterprise operating in Ankara which intends working in the framework of lean production, which aims to simplify production in its operation and wants to get rid of unnecessary activities. First of all; this study, which is accompanied by 3 experts who have knowledge about the internal dynamics of the business, prioritized waste items which will be used with the aim of simplifying the production of the business. Then to be used in lean production studies it has been decided to define the lean production techniques to be used in determining the root causes of these waste (Value Stream Map, Genchi Genbetsu, 7 Quality Tools etc.). For this two-stage integrated approach, the fuzzy AHP and the ELECTRE method are used which are among the multi criteria-decision-making methods.

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**Keywords: Lean Production, 7 wastes, MCDM, fuzzy AHP**

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**Ranking the Dealers' in the Basis of Organizational Performance  
Measurements: A real-world application**

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One centered large organizations that use the dealership system to provide services in different geographical regions need to measure and evaluate the performances of the dealers according to the several indicators in order to ensure the same quality of service and efficiency in all dealers. These large organizations need to assess their dealers' performance taking into account these indicators. Ranking of the dealers according to the organizational performance measurements and determining the ineffective ones to conduct studies for this situations are important for the competitiveness and continuity of the business. In the solution of the problem, a two-stage integrated structure was used. In the first stage, the Fuzzy Analytic Hierarchy Process (FAHP) method was used to weight organizational performance criteria. In the second stage, the dealers are taken as an alternative and ranked according to the performance criteria by the method of Promethee. It is considered appropriate to utilize fuzzy logic reasoning in weighting the criteria since there is no certainty in the organizational structures within the framework of the selection criteria and the linguistic expression of some of the selection criteria handled at the same time leads to a more accurate conclusion. In this study, alternatives are ranked by Promethee method, which is based on the pairwise superiority comparison between the alternatives

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**Keywords: Performance Evaluation, MCDM, Organizational Performance, fuzzy environment**

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## **Two-Stage MCDM Approach in the Selection of Manager Training Techniques**

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Convenient management of the qualities of the managers who play effective and strategic roles in business decisions is very crucial. To develop and improve in terms of their managerial sense is significantly related to the training for the personnel who are nominated to be managers by the Human Resources (HR) department. The techniques used in the training of the manager in the literature are divided into two main groups: on-the-job and off-job manager training techniques. In this study, on-the-job manager training techniques which is highly important for the business and used for managers' training were evaluated. A two-stage integrated methodology was used to solve the selection problem. Hesitant Fuzzy Analytical Hierarchy Process (HF-AHP) was used to obtain criteria' weights. The weights obtained with HF-AHP were included as an input to the MOORA method used to order on-the-job training methods. This method can be preferred because the results obtained from the MOORA method are reliable and the calculation time is shorter than other methods. The alternatives on-the-job training techniques were ranked using MOORA method due to the results obtained from the MOORA method are reliable and the calculation time is shorter than other multiple criteria decision making methods. At the same time, the easy-of-use of the method will enable HR experts to easily apply it to the different HR decisions they will be made later. The fact that the criteria affecting the choice of on-the-job training techniques cannot be distinguished from each other by certain lines and that it will be subjectively assessed has necessitated the inclusion of Hesitant Fuzzy LTS to the study. The criteria for the techniques were determined in the context of brainstorming conducted by HR experts and the authors. According to the ranking that will be done according to the criteria affecting on-the-job training techniques, the HR has made it possible to give this strategic decision with a scientific approach.

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**Keywords: Human Resource, MCDM, Manager Training, Fuzzy Environment**

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## **Warehouse Optimization for Raw Materials using Linear Programming**

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This study presents a real world application of warehouse optimization in a manufacturing company. First of all, the actual warehouse capacity usage percentage is calculated with the current raw material layout. Then, capacity requirements for each raw material are calculated using information comes from production planning and supply chain management departments. The objective of this study is to find an optimum warehouse design for raw materials ensuring effective warehouse storage through providing maximum storage space and volume by calculating the space to be allocated in the warehouse, with respect to palette and package sizes and volumes of each raw materials. In accordance with this purpose, a linear programming model has been developed to solve the problem. The result of the model is used as a base design for the warehouse where a heuristic approach is applied to find a realistic warehouse storage design. As a result of the study, daily transportation rate of raw materials is reduced by 21.3 % in total.

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**Keywords: Warehouse Management, Linear Programming, Optimization, Raw Material Handling**

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## Optimization for Extracting Butyric Acid from Aqueous Solution

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Goal Programming, one of the most suitable kinds of programming in detecting the most optimum solution between the purpose, answers the solution of the problem is occurred in lots of sector such as chemical, civil, machine, tourism and etc. In this study, an extraction process is observed and due to an output of the reaction, a non-linear multiobjective programming is created. Dealing with a subject such as extracting acids from water solution possesses financial, toxic and physical optimization. Butyric acid is one kind of this acids, which is also one of the most useable carbonic acids. In a continuous fermentation process to make optimal production is only capable of making butyric acid obtaining as a product extracting from water solution. The liquid–liquid equilibrium data for water butyric acid solvent (octanol, ethyl butyrate, ethyl valerate, ethyl nonanoate, acetophenone and diethyl malonate) ternary systems were determined experimentally at 298.15°K. Adsorption experiments are done with an ion exchanger in different adsorption concentrations. Dispersion coefficients of butyric acid between aqueous and organic phases, separation factors and selectivities calculated and the data obtained from the experiment is put on the programming part to find an optimal solution for our goals and decision variables. In the way of making extraction optimal is used as an extractant in which involves tributyl phosphate amine is studied and calculated for organic phases, separation factors and selectivities. Usage of amine is also another constraint for our study cause of the toxicity.

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**Keywords:** Linear Regression Models, Multi-Objective Programming, Non-Linear Optimization, Butyric Acid Extraction, Process Optimization

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## **Cumulative Belief Degree Approach for Group Decision Making Problems with Hesitant Fuzzy Linguistic Evaluations**

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In multi-criteria group decision-making (GDM) problems, flexibility in the assessment of decision-makers increases the quality of the evaluations improves the quality of the solution. In the case of complex decision-making problems, decision-makers may not be certain in their evaluations and may have hesitancy about which linguistic term to indicate. In a case where there are doubts among several linguistic terms, the Hesitant Fuzzy Linguistic Terms (HFLT) provide flexibility of indicating more than one linguistic term. In recent years, the studies including HFLT increases rapidly. There are various kinds of methods used in the literature for GDM problems with HFLT. The Cumulative Belief Degree (CBD) is a solution approach built on fuzzy linguistic terms and belief structure for multi-criteria GDM problems. The CBD approach has been applied to many decision-making problems with different evaluation measurements. In this study, a GDM problem in which decision makers have evaluated alternatives using HFLT has been solved using the CBD approach. Transformation formula for converting the HFLT to belief degrees are introduced. The applicability of the approach is shown by implementing the approach to a problem in the literature.

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**Keywords: Hesitant Fuzzy Linguistic Terms (HFLT), Multi-Criteria Group Decision Making, Cumulative Belief Degree (CBD)**

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## **Applying Statistical Process Control for Ultra-Fine Calcite Production**

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Turkey has a large number of industrial minerals and calcite is one of them and is used as filler in the industries such as plastics, rubber, and paint in order to gain a variety of features to products. The fine size (micronized) is a previous condition for calcite to be used as filler. This particle size covers a scale ranging from 100 to 1 microns on the basis of d50. In this study, statistical process control is used in order to monitor an ultra-fine calcite production process. For this particular purpose, this study examines the ultra-fine calcite production process within the specification and control limits with the X-bar and R control charts. For data collection phase, the average percentage of d50 and d97 particle sizes ( $\mu\text{m}$ ) of each sample was determined for 20 days' ultra-fine calcite production process. Finally, the lower and upper specification limits, and process capability indices were specified for the ultra-fine calcite production process.

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**Keywords: Quality engineering, Calcite, Ultra-fine grinding, Statistical process control, Process capability indices**

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## **A Java Applet Simulator for Imperfect Maintenance with Kijima Models**

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Imperfect maintenance set the virtual age of machine less than initial age each time maintenance activities are performed under Kijima Models. This study presents a java applet simulator for imperfect maintenance with two popular Kijima models under the assumption that, time to failure is governed by Weibul distribution while time to repair is exponentially distributed. The user can set the distribution parameters, as well as the kijima type and its parameter along with the simulation parameters such as run length and number of observations. The simulator generates plots of machine availability that converges the steady state by time. Simulator is demonstrated with a specific case depending on parameters specified.

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**Keywords: imperfect maintenance, kijima models, java applet**

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## **Personalization in Airline Revenue Management: An Overview and Future Research Prospects**

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Airline revenue management (RM) focuses on the optimization of booking process to accept a reservation with the right conditions at the right time for the right fare for a future flight. Historically, academics have developed overbooking, single-leg seat inventory and origin-destination control, dynamic pricing, and forecasting models with a target to maximize airline revenues. Airlines have applied reservation limits to their seat inventories and tried to determine the number of seats for each fare class to increase their revenue gains. However, limitations on technology (e.g., distribution systems and access to passenger information) prevented airlines to generate customized offers to customers. Recent advances on technology, such as increasing usage of direct channels (i.e., internet) and International Air Transport Association's New Distribution Capability, will soon provide consumers to encounter specialized offers in the booking process. Therefore, the aim of this study is to provide a survey for personalization in airline RM. In operations research, personalization in airline RM has been studied since 2009 by applying dynamic pricing models in general, and it is relatively a new area of research. For this reason, this study will cover a brief introduction to airline RM, and a systematic review of existing research will be conducted for the personalization in airline RM in operations research. It will also suggest a number of possible directions for future research.

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**Keywords: Revenue Management, Airline, Personalization**

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## **Occupational Safety and Health Operations in Call Centers**

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Subject is the occupational safety and health operations of Tepe Services and Management Company at Ankara Bilkent, in Call Center. Evaluation is made by using AHP method. AHP, lets deciders to model the complex problems in a hierarchical structure, showing the main target of the problem, criteria (Noise, lighting, thermal comfort (Ergonomic factors)) sub-criteria and alternative (Enerjisa (Retail and Distribution), IDO, Customer Relations, Quality Department) relations.

If we perform comparisons between four locations for Call Center, common negative feature for each unit is the fact that each one is poorly ventilated and without any windows. (These cannot also benefit from sunshine.) Quality Department and Customer Relations Department having doors, Enerjisa and IDO departments having no doors and departments being directly in open spaces makes a difference in terms of ergonomics. Another privileged aspect of Quality Department is that they only listen to the talks. In other departments it goes as listening and responding.

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**Keywords: Call center, noise, thermal comfort, health and safety**

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**A Research on Problems in Existing Delivery Process in Cargo  
Transportation and Evaluation of New Methods: Malatya District  
Example**

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Tendencies of consumers towards shopping through internet has been increasing gradually as e-commerce has developed in recent years. Products shipped to consumers through cargo firms in online shopping. The quality of services provided by cargo firms in delivery process can have a significant impact on consumers' satisfaction, hence, problems experienced in this process can be associated to the product, brand and the seller causing an overall dissatisfaction.

In this study, a research to determine attitudes of consumers towards new delivery methods such as locker collection widely used abroad as well as problems encountered during delivery process was conducted. In the research, the effects of problems experienced on new delivery methods and intention of consumers about online shopping were analyzed. İnönü University's academic and administrative staff that have employee profiles all through Malatya were determined to be the research's population. İnönü University Campus Region with its more than 3000 employees was identified to experience intense delivery traffic upon interviews with cargo firms. This intense traffic along with employees from every district of Malatya was evaluated that the determined population has the adequate representability of Malatya city. At the end of research, statistical analysis was conducted to evaluate cargo firms in regard to research goals.

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**Keywords: Cargo Transportation, New Delivery Methods, E-Commerce**

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## **Impact of Total JIT on Competitive Advantage of Multinational Fast Food Restaurants**

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The purpose of the current research is to investigate the impact of Total JIT on Competitive advantage in Multinational Fast Food Restaurants in Jordan. The study covered all five multinational companies working in this field in Jordan. Data collected by questionnaire from 186 out of 250 manager. After confirming normality, validity, reliability and relationships between variables, multiple regressions conducted to test the hypothesis. Results show that the Total Just in Time sub-variables are highly implemented, JIT operation has rated the highest implementation, followed by JIT selling and finally, JIT purchasing. Competitive Advantage dimensions are also highly implemented, where quality has highest implementation, followed by speed, then reliability, cost and innovation, respectively. Furthermore, the results show that there are strong relationships among total JIT sub-variables, and strong relationships among competitive advantage dimensions, and strong relationships between total JIT sub-variables and competitive advantage dimensions. Finally, the relationship between total JIT and total competitive advantage is very strong. Results also show that all Total JIT sub-variables affect Competitive Advantage of Multinational Fast Foods Restaurants in Jordan. The JIT Selling was having the highest effect on Competitive Advantage, followed by JIT Operation, then JIT Purchasing. The study recommends adopting Total JIT in all industries, because it affects competitive advantage of almost all companies.

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**Keywords: Total JIT, Competitive Advantages, Multinational Fast Food Restaurants**

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## **Group Decision Making for Criteria Importance Determination in Student Project Team Formation Problems**

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This study presents some group decision making approaches for criteria importance determination in student project team formation problems. A typical student project team formation problem might involve several restrictions and requirements as well as the preferences of the potential team members, usually students and academic advisers. A recent study of Cavdur et al (2018) presents a two-phase binary-goal programming-based approach for solving such a student project team formation problem which basically includes two types of allocations; the allocations of students and academic advisers. In this study, we present some group decision making approaches for criteria importance determination in the student project team formation problem presented in the study of Cavdur et al. (2018). The results of the surveys conducted on two samples (of students and academic advisers) are used to obtain the perspectives of each person as a potential team member. Some aggregation methods in group decision making are then used in order to produce the corresponding group decision in each case. Finally, resulted group decisions are used as the inputs of the goal programming models (i.e., the weights or the priorities of the goals). Optimal team formations for different cases are analyzed with respect to some problem metrics.

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**Keywords: Student Project Team Formation, Student Project Allocation, Multi Criteria Decision Making, Group Decision Making, Goal Programming**

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## **Failure Evaluation of Public Transport System in İstanbul by Using Markov Chain**

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Markov chain is a stochastic research technique that makes it possible to obtain information about the future situation of an activity that is now taking place. Markov chains also have ability to predict where the system will be located at a certain point, as well as predict the long-term state of the system. In practical applications, Markov chains play an important role in decision analysis, since decision makers often try to make decisions in an uncertain situation where traditional decision theory cannot cope. Markov chain is useful approach that can be applied in many different studies in many different areas. However, it is not a common approach that we meet among the methods used for public transportation. In this paper, we have performed failure estimation with Markov chain method for the BRT system-better known as Metrobus-used in İstanbul. With this method, we also predicted in what condition the vehicles used in the Metrobus system would be in the long run. Thus, we have demonstrated the availability of the relevant method in this area as well as presenting a general framework for estimating failures in public transportation management. We aim that our paper will create a roadmap for researchers who study on this area.

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**Keywords: BRT, Estimation, Failures, Markov Chain**

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## **A Hub Location Model for Cargo Delivery Systems**

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The hub location problems are frequently encountered in network design applications of cargo delivery systems, airline systems, waste collection systems and telecommunication systems. When application topics are examined, it is clearly seen that the problems in each application topics have specific characteristics. Most of the studies in the literature are not taken into consideration the characteristics (land price, highway intensity, industrialization level, population etc.) of the hub sites. Therefore, there is no validity of solution obtained for real life problems. In this study, we focus on cargo delivery systems and developed mixed integer linear programming (MILP) model integrated with Fuzzy Analytical Hierarchy Process (FAHP) method. The candidate hub regions are weighted over specific features and these weights are taken into consideration in the model by FAHP method. The developed model is applied on the Civil Aeronautics Board (CAB) datasets and the results are compared with other studies in the literature. Also, the model is implemented Turkey Postal Service (PTT) and obtained solutions are examined with current structure of PTT.

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**Keywords: Postal Service, Hub Location, FAHP**

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### **Comparison of Revaluation Procedure of Properties**

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The value of the economic assets included in the records of the enterprises whose earnings are determined on the basis of the balance sheet basis remains as the value at acquisition date according to TPL (Tax Procedure Law) and cannot present its real value. Under article 5 of Law No. 7144, Provisional Article 31 have been added to Tax Procedural Law No. 213 and it enables to revalue the immovable properties. The entrepreneurs will be able to increase their value by multiplying their immovable assets by the maximum value of 2.9772 based on the date they are activated. However, 5% tax is required on the net value increase. The negativity of the amount of tax shall be deducted from the amortisation calculated on the increased value in the long term. With this application, the assets and equity amounts of the companies will go up and the equity / liability ratio will increase so that their credibility will increase therefore, they will be able to use the loans more easily. The economic assets used in TAS (Turkish Accounting Standarts) revaluation applications are not only immovables but all tangible assets. The main aim is to raise or lower the relevant asset to the value of the market. Although there is no tax payment in the revaluation increase due to the valuation of tangible assets, it is possible to increase the tax assessment due to the value increase in the value of investment properties appreciation and the income recording. Reviews made on the financial statements of the BIST 100 index show that 12 enterprises valued their tangible fixed assets and / or investment properties according to the method of revaluation of tangible fixed assets and / or investment properties in 2007 and this number reached to 56 in 2017.

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**Keywords: the revaluation, at fair value, Turkey Accounting Standards, valuation coefficient**

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## **A Social Spider Optimization Algorithm for Hybrid Flow Shop Scheduling with Multiprocessor Task**

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Hybrid flow shop scheduling with multiprocessor task (HFSPMT) is a strongly NP-hard problem that has a wide range of applications in several real-life industrial environments. Due to its essential complexity and practical relevance, HFSPMT has been of an increasing interest for researchers and industrialists in the last two decades. Social spider optimization (SSO) is a recent swarm intelligence algorithm that has been rarely applied on combinatorial optimization problems. In order to make a small step toward having an idea about its effectiveness in solving combinatorial optimization, in this work, a new SSO algorithm is proposed to solve HFSPMT problem with the objective of makespan minimization. The proposed algorithm is experimented on benchmark instances and compared with other existing swarm intelligence algorithms in the literature. The obtained results and the comparisons show that the performance of the proposed algorithm is highly competitive in terms of solution quality.

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**Keywords: Metaheuristics, multistage hybrid flow shop, multiprocessor tasks, social spider optimization**

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## **Bus Driver Scheduling in Interurban Transportation System**

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Scheduling problem is one of the major topics in operational research which aims finding optimum resource allocation given time period considering constraints. In this work, bus driver scheduling problem is modeled in interurban transportation by finding minimum number of bus driver scheduling for certain trips weekly. Work, break, layover duration, legal rights, are the constraints in the system. Problem solution consists of two-stages. First, Set Covering Problem (SCP), is utilized to locate feasible region. SCP results with a feasible region by obtaining all feasible duties. SCP. Duties consist of work units which are parts of the trips driver changes occur. In the second stage, a metaheuristic optimization approach is applied so as to minimize total driver numbers. Among multiple metaheuristics algorithms, Genetic Algorithm (GA) is chosen due to its strong diversity ability arising from mutation and cross-over strategies with a simple and intuitive implementation. In this study, we propose a GA-based bus driver scheduling framework for solving this problem in efficient way. We present the efficiency of our approach by testing it on a pilot data set provided by one of leading transportation companies. The results clearly indicate the success of our framework.

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**Keywords: Bus Driver Scheduling, Optimization, Genetic Algorithm, Set Covering Problem**

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## **Evaluation of Job Recruitment Process Using Multi Criteria Decision Making Approach**

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Selection of the most suitable employee is a strategic decision that can affect operational success of a firm. Job Recruitment Process is time consuming and resource intensive process that should be managed with care. Therefore, Decision Makers (DMs-experts) are often actively involved in decision making stages when discussing about which alternative to work with. This can also be seen as a sort of Multi Criteria Decision Making (MCDM) problem. In such processes, GDM involves multiple experts who collaborate for reaching consensus. This study utilizes a combined Intuitionistic Fuzzy (IF) Group Decision Making (GDM) model that consists of the Intuitionistic Fuzzy Analytic Hierarchy Process (IF-AHP) and Intuitionistic Fuzzy Technique for Order Preference by Similarity to Ideal Solution (IF-TOPSIS) methods for effectively evaluating job recruitment process. In order to obtain a more complete evaluation and more precise results, IF-AHP is used for determining criteria weights, whereas IF-TOPSIS methodology is conducted for ranking alternatives. The utilized approach is applied on a case study for assessing the most appropriate alternative of chosen firms in Turkey .

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**Keywords: Multi Criteria Decision Making, Group Decision Making, IF-AHP, IF-TOPSIS**

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### **Workforce Planning on the Topic of Forest Fire**

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Forest fires are one of the leading natural disasters that affect all countries due to their consequences. The fires are an important threat to the world, burning millions of hectares of forest each year, fighting against fire, expressed in quadrillion, and even life and property losses. Workforce planning is a type of problem that is often encountered in contingency planning, and forest fires are an important topic heading in this sense. The basic principle of Workforce Planning is to ensure that the right people in the right jobs are assigned to the right job, at the right time, in the right amount, in the right place, at the right cost. For the solution of the problem, the application will be made in the General Directorate of Forestry. Due to the model size and decision making mechanism, modeling of the solution method with linear mixed integer programming is considered and it is envisaged that the heuristic optimization techniques will be used in the solution.

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**Keywords: GDF, Workforce Planning, Forest Fires, Decision Making Techniques, Heuristic Optimization Techniques, Mixed Linear Programming Techniques**

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## **Application of Reliable Focused Maintenance Approach in Automotive Side Industry**

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In the early 1930s, since run-to-failure approach was not sufficient to solve the problems that arise, maintenance and repair applications focused on carrying out programmed maintenance and activities related to these methods. These focus breakdown types have improved the concepts of equipment activity and reliability. The aim of this study is to develop a model that will provide a holistic perspective with reliability centered maintenance (RCM) planning by examining operating equipment in terms of efficiency and effectiveness. It has been shown that the proposed maintenance program approach improves the equipment.

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**Keywords: Automotive supplier industry, reliability centered maintenance, total equipment effectiveness**

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## **The Formation of the Organizational-Economical Mechanism of Strategic Potential Creation of the Light Industry Enterprises**

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The definition of the enterprise potential and its varieties has been investigated. It's been determined the place and the role of the strategic potential and observed an aspect of it as it is fundament of a strategic management of the enterprise. It is proved the necessity of the creation of a strategic potential of the enterprise and it's been conducted the analysis of the instruments of it's construction among which the general attention is focused of organizational-economical mechanism. It's been investigated the peculiarities of a strategic potential of its influence upon the formation of an organizational-economical mechanism. It's been investigated factors which influence upon the formation of such mechanism as a mechanism of a strategic potential creation in the field of the light industry and it is development requirements up to its construction.

It's been distinguished the principal approaches to the formation of the organizational-economical mechanism of the strategic potential creation and suggested the structure of its construction. It's been estimated the necessity of constant monitoring of this mechanism. It's been neggested to give an evaluation of an organizational-economical mechanism of the strategic potential creation by means of the indexes of the enterprise efficiency. The investigated mechanism was analyzed and it's been searched its influence upon the results of the enterprises' activities and enlightened the advantages of its impacts in the field of the light industry enterprises.

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**Keywords: strategic potential, strategies, organizational-economical mechanism, light industry, evaluation**

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**Non-compensatory and Sequential Multi-Criterial Decision Models for  
Large Scaled Problems: An Application on Stock Selection and  
Ranking in ISE**

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The problem of multicriterial ranking or choice has become more complicated because of the existence of large number of available alternatives, e.g. the massive amount of products and services supplied on the Internet. The compensatory methods (Weighted Sum, AHP, TOPSIS etc.) has many real-life applications. In fact, they require decision maker (DM) determine criteria “weights” directly or by making pairwise comparisons. Since they demand DM to have an unrealistically large information processing capacity, most of them are only applicable for small sets of alternatives. For large sets, using simple procedures that require less information from DM but result in some-sense rational, is highly-demanded. Such techniques stem from the classical -social- choice theory (Borda, Pareto etc.), non-compensatory multicriterial models (based on aspiration levels, tournaments etc.) and their multistage structures. Since the studies that employ these methods on real data sets are very rare, this study aims to review their properties and illustrate their applicability on the stock selection and ranking problem in Istanbul Stock Exchange (ISE), Turkey. Using recent financial ratios of the companies as criteria, the orderings of the stocks constructed via different methods. Results are evaluated and methods are compared with respect to their rank similarities.

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**Keywords: Multi Criteria Decision Making, Non-Compensatory Methods, Sequential Choice Models, Stock Selection, Istanbul Stock Exchange**

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**Multi-Criteria Decision Making for Supplier Selection in Uncertain Environment: A Case Study in Defense Industry**

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Strategic objectives of an organization are divided into various components, such as financial efficiency, process excellence and customer value. Supply chain management affect all of these components in a direct or indirect way. Therefore, supplier selection, evaluation and building sustainable collaboration create value beyond the core function of supply chain management and constitute a substantial source of strategic power and competitive advantage for organizations. In this case, an approach for supplier selection in uncertain environment is suggested using fuzzy Multi-Criteria Decision Making (MCDM) techniques. The sectorial uncertainty factors such as market dynamics and volatile environment affect strategic and operational decision-making situations including supplier selection. Together with uncertainties, sorting criteria to determine the most appropriate problem structure and comparison of opinions of experts from different areas are included to increase robustness of findings. These aspects create a context representing the big picture and cultivating new perspectives in terms of procurement strategy and supplier selection. Supplier selection and evaluation in defense industry are important tasks to be dealt with. The goal of this paper is to provide a case study by describing the special characteristics of these decisions in defense industry and obtaining results incorporating aforementioned uncertainties.

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**Keywords: Supplier Selection, MCDM, Fuzzy Logic, Uncertainty, Defense Industry**

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**Application of Time Study in a Pharmaceutical Distribution Center: A  
Case Study in Teresina - PI**

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The following work is aimed at analyzing the routine production of a Pharmaceutical Products Distribution Center located in the city of Teresina - PI, specifically in the medicine conference sector. In the case of data collection, methods engineering tools were applied in different phases of the research to identify opportunities for improvement in the medication conference process. To analyze the productivity, the chronoanalysis of three different lecturer standards was performed: High performance lecturer (1), Medium performance lecturer (2) and Low performance lecturer (3). Complementarily, the time measurements were performed in three different periods: shift input, shift mode and end of shift, in order to associate the characteristics of the process - at these time periods - with daily productivity. The data collected at this stage of the research were screened and tabulated through Microsoft Excel software, and converted into graphs, tables and tables. Thus, through the chronoanalysis, it was possible to identify the points that affected the production of the employees, besides making possible the proposition of solutions for the company.

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**Keywords: Study of times, Engineering Methods, Productivity, Distribution center**

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**Emotional Evaluation of the Iron with Semantic Differential Scale**

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Today, consumers tend to purchase products that have emotional appeal rather than functional purposes. Thus, to attract customers' attention, designers use many different methods in the design process when designing the emotional appeal of products. This study presents the usage of a semantic differential scale for the stage of new product design and generating a database of Turkish adjectives related to the interaction with iron. We performed a survey about iron usage through current products in the market with users. Then, we performed a data analysis from binary matrix of correlation and antonyms generation. When using the semantic differential scale method with 9 adjectives which can assist the user evaluation with related to iron, the safe, it was found that ergonomic and pratic iron design will meet the expectation of the customer.

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**Keywords: Semantic Differential Scale, customer satisfaction, product design**

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## **Determination of Denim Fabrics for Summer Shirt Using Multi-Criteria Decision Making**

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Multi-Criteria Decision Making (MCDM) is the fastest-growing tool in operations research that deals with selection problems under the presence of multiple and conflict criteria and alternatives. MCDM has different approaches and methods that distinguish themselves in terms of procedures, theoretical assumptions, and the type of decision addressed.

This study presents a MCDM approach to select the denim fabrics as summer shirts. A denim fabric is intended to be used as summer shirts should have four decision criteria of fabric quality parameters as weight, stiffness, tear strength and tensile strength. The selecting and ranking the best alternative for a particular end-use requirement is a complex task, as multiple decision criteria have to be considered simultaneously. The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method has been used for ranking 10 denim fabrics in terms of their overall quality value considering their applicability as a summer shirt.

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**Keywords: Multi-Criteria Decision Making, TOPSIS Method, Denim**

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## **Fuzzy Rough Approach for Telecommunication Sector Churn Prediction Attribute Reduction**

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The churn is one of the most important issues in the telecommunications industry for many reasons. Besides it is a fact of the telecommunication industry and companies should be able to cope with this situation. This situation is known to have a significant impact on firms as it leads to a decrease in their income and an increase in marketing expenditures. Obviously, the churn gives them the opportunity to inspect themselves so they can do their jobs better. At this point, companies can better understand their customers and their wishes. In the telecommunication sector, churn analysis is increasingly important due to market conditions. For this reason, in this study, an attribute reduction model has been proposed for this problem, in accordance with the characteristics of customer data. In order to achieve realistic results as much as possible, a number of attributes have been compiled for each customer, with detailed studies and expert opinions. To cope with the large-scale characterization of the data set, a fuzzy rough set based FRQR (Fuzzy Rough Quick Reduct) selection was applied.

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**Keywords:** Attribute Reduction, Churn Prediction, Fuzzy Rough Attribute Reduction

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## **Feature Selection Application for Demand Forecasting in Furniture Industry**

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In present day, competitive environment's effect and increasing product diversity have considerably led to an increased interest in advanced demand forecasting methods. In global economy, major companies have many factors depending on the company, the country and the world which affect the product demand forecasts. In the furniture sector, demand forecasting is increasingly important due to market conditions. Besides, significance levels of these factors may differ for each product in the company. For this reason, in this study, feature selection approaches are applied for estimate product demands of a celebrated furniture company, which has an important position in the world and located in Kayseri City. Seventeen different input features are evaluated for forecasting the demands of nineteen different products. Weekly (152 weeks) demand data for 2015, 2016 and 2017 are considered for each product. Representative feature selection techniques in literature were applied to obtain the best features and the results are consistent.

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**Keywords: Feature Selection, Demand Forecasting, Furniture Sector**

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## **The Application of FCM and Fuzzy Regression to Models with Different Parameters in Fuzzy Modeling**

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In this paper, a public time series data which is provided by Denmark government including annual import and export rates depending on different financial parameters is used. Firstly, principal attributes are determined by correlation analysis for eliminating independent ones to avoid bias in modeling. Then linear regression model is created to see how output can be predicted by selected attributes as input. Then fuzzification started, membership values are calculated for the parameters of specific degree of fuzziness and cluster numbers. All these membership values are stored in matrices and their transformation matrices are calculated based on the most commonly used ones like logarithms, square root, or 2nd and 3rd powers, and stored in different matrices, as well. These matrices are used together with pre-selected attributes as input to predict single output parameter in Fuzzy Regression Analysis Method. A total of 248 different models are created to see general pattern of model accuracy changes depending on cluster numbers and degree of fuzziness. After the investigation of these models, we tried to set up some criteria to select the most suitable model, which can be used for a better decision making. Moreover, there are several outcomes which guide researchers for FRA and usage of fuzziness parameters in the models. These outcomes provide a better opportunity to see the significant effects of degrees of fuzziness and cluster numbers within the model. Overall discussions are done, future studies have generated based on this huge database on modeling.

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**Keywords: FCM, Fuzzy Regression, Fuzzy Modeling**

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## **Energy Supply Chain and Energy Security**

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In general, supply chain security is a prominent part of energy security, which is defined as “uninterrupted availability of energy sources at an affordable price” by International Energy Agency (IEA). In more detail, energy security can be separated into two sub-definitions as short and long-term energy security. Short term energy security focuses on the ability of the energy system to react promptly to sudden changes in the supply-demand balance. Here, sudden changes refer to level of readiness to any kind of shock interruption at energy supply because of terrorist attacks, wars, hurricane and so on. On the other hand, long term energy security mostly focuses on timely investments to supply energy in line with economic developments and environmental needs. Energy systems are essentially a supply chain comprising of multiple and interrelated sub-chains based around different fuels, different technologies in line with the type of fuels, infrastructures and actors, operating at different scales and locations from extraction, exports/imports and delivery to the end users. Therefore, management of this complex system is a key challenge for countries which import energy at different levels by means of different sources from single and/or multiple countries. From this point of view, this paper analyzes supply chain management at energy sector in the world and focuses on the potential risks for energy security of countries that are dependent to energy import like Turkey.

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**Keywords: Energy Supply Chain, Energy Security**

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**A Multi-Dimensional Performance Measurement of Petrochemical Joint Venture Projects through Partial Least Square Structural Equation Modeling (PLS-SEM)**

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The importance of partner selection with regard to any type of cooperation between partners in International Joint Venture (IJV) has been agreed on, but the amount of studies analyzing the relationship between partner selection, operation and IJV performance as a whole framework has so far been surprisingly limited. This paper tries to shed some light on this gap to obtain a better understanding of factors that influence formation and operation stage of an international joint venture and measure the performance of IJV as a three-dimensional construct considering the performance of the project, the IJV partners, and the IJV management. The study aims to use partial least squares (PLS) as an evolving approach to structural equation modeling (SEM) methodology to achieve greater understanding of the intricate network of relationships between factors. The conceptual model is built up and then we applied this model in the analysis of Persian partners of petrochemical JVs through a questionnaire survey. The results show that the three dimensional IJV performance depends on “identifying potential partners” and “selection” as well as “inter-partner fit” and “strategic fit” variables. At the end, conclusions are made and limitations are discussed together with an outline of future research directions.

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**Keywords: International Joint Ventures (IJV), Petrochemical projects, PLS-SEM, Performance measurement**

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**Identifying Managerial Factors of Formation and Operation Stage in Petrochemical Joint Venture Projects through Data Envelopment Analysis (DEA)**

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International Joint Venture (IJV) has been one of the main foreign market entry due to increased complexity, uncertainty and risk of international projects. Besides that, selecting the right partner and acceptable range of inter-relation between partners are important for creating value in alliances. The goal of this paper is to analyze the effect of managerial factors of formation and operation stage in petrochemical joint venture projects through data envelopment analysis (DEA). Data collection was performed in petrochemical plants through a questionnaire. Then, reliability of the data and the importance of each factors was calculated by Cronbach's alpha and Wilcoxon test, respectively. Next, the best DEA model is selected based on average efficiency and statistical test. In addition, sensitivity analysis is performed to identify the most effective factors. Finally, the suggested model is validated and verified through statistical experiment. The proposed approach would help project managers of petrochemical projects to have a comprehensive understanding of JV contracts as a whole framework.

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**Keywords: International joint venture (IJV), Petrochemical projects, Data envelopment analysis (DEA), managerial factors**

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## **Optimization Oil Production Rate with IPC Contract Effects in Oil Development Projects**

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Iran's petroleum industry requires investments of US\$ 100 billion for developing oil and gas industries. Therefore, Iran developed a new type of service contract with IOCs, known as Iranian petroleum contracts (IPC) for absorbing IOCs' technology and investment. The oil production rate and amount of investment are the most important variables in development and exploitation of oil fields under IPC contracts, which has a significant influence on oil field income and net present value (NPV) of projects. Therefore, this paper presents a new model for optimizing the amount of investment and oil production rate under IPC contract for different contract conditions in order to maximize the NPV of IOCs. For this purpose, this paper first introduces the fiscal regime of IPC contract and then presents the model for optimizing the amount of investment and oil production rate. A numerical example and sensitivity analysis are further used to illustrate the performance of the proposed model. The results of the implementation of the model indicate that the maximum NPV of IOCs occurs at the highest oil production rate. The sensitive analysis of different price conditions shows that oil prices do not change much on the optimal oil production rate.

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**Keywords: Oil Production rate, Contract effects, IPC Contract, oil development projects, Economic benefits**

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## **A General Overview on Industry 4.0 and Society 5.0: A Case Study of Awareness of Industry 4.0**

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Industry 4.0 is now known as the last stage of economic production models of societies and is defined as the smart production economy of the future in the digital transformation of businesses. In this study, we have searched for whether our country is ready for the Industry 4.0 process, awareness and feasibility in enterprises and Society 5.0 philosophy. The research on industry availability, awareness and applicability in business has been obtained through questionnaires from companies operating in various sectors in the industry. The questionnaire consists of three parts: Demographic Information, Awareness and Practice of Industry 4.0, and Social Responsibility of the Business. As analysis methods in research; Reliability and validity analysis, Descriptive statistics, Single sample T test, Chi-square test and Data mining methods were used for Neural Network and decision tree algorithm C & R Tree Algorithm. When examined from the results of the survey, it was found that the digital transformation in Industry 4.0 is important for the participants. It is also seen that the Industrial 4.0 revolution and the Society 5.0 philosophy should not be considered separately, the fear of employment in society with Industry 4.0 is being removed from the Society by philosophy of 5.0, and society is being perceived as a threat to robotics technology, not contrary to technology.

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**Keywords: Industry 4.0, Society 5.0, Industrial Revolution, Data Mining, C&R Tree Algorithm, Artificial Neural Network**

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## A Model Proposal for Course Selection with the Fuzzy Moore Approach

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In this study, the importance of courses in industrial engineering undergraduate programs has been researched. Compulsory and elective courses given in industrial engineering have been investigated under the determined criteria. Research, academics working in the industrial engineering department in Turkey, the proper course of materiality is an implementation of the fuzzy logic survey work on assessing the work. The sample order with 32 samples prepared by the academicians responding to the questionnaire was prepared by using «Fuzzy MOORA» technique as compulsory and elective courses. Studies on course selection, when the international literature is examined, it is seen that the «Fuzzy MOORA» technique is not used. It is evaluated that MOORA method, which is a new criterion decision method for course choice, will contribute to international literature as «Fuzzy MOORA» approach with fuzzy logic.

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**Keywords:** Course selection, multi criteria decision making, fuzzy MOORA technique

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## **Using the Analytic Hierarchy Process for Decision Making in Port Selection for Ship Agent**

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Recently, the number of people who want to prefer cruise rather than holiday camp or holiday village have been increasing. There are some reasons why many people think about like this such as discovering different places in limited time and having much more options. In addition to this, thanks to increasing the usage of internet and many advertisement, many people want to visit different places. That is why, tour companies provide their customers with many options like cruise in summer time. Between these options, one of the most important decisive point is port of call. Port options are Antalya, Istanbul and Bodrum. In this paper, it will be analyzed that which port will be more preferable than others. Analytical hierarchy process (AHP) which is multi-criteria decision making methods are employed in the study. Weights of criteria are calculated with AHP method is used in the ordering of alternatives. According to the obtained results, social and touristic opportunity is determined to be the most significant criterion in port selection. Bodrum is the most preferred cruise by the people participated in the study.

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**Keywords: Multi Criteria Decision Making, Analytic Hierarchy Process**

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## **Forecasting Monthly Electricity Consumption in Turkey Using Artificial Neural Network**

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Electricity is an essential tool for sustainability of life. By the economic growth, increase in population, rapid urbanization and industrialization, demand of electricity is increasing significantly. Electricity generation, distribution and transmission activities should be planned to meet the increasing energy needs. For this reason, accurate forecasting of electricity consumption is crucial and fundamental to efficient electricity generation planning. The main objective of the present study is to apply the Artificial Neural Network (ANN) methodology to predict the monthly electricity consumptions in Turkey. Monthly forecasting of electricity consumption has importance for scheduling of fuel supplies, planning, maintenance of the grid and electricity trading. Moreover, monthly electricity consumption forecasts are influenced by many socioeconomic, demographic and climatic variables. In this study, average temperature, average rainfall, value of imports, value of exports, consumer price index and production of total industry are used as independent variables and their effects on electricity demand are analyzed. Totally, there are 276 monthly data used which ranges between 1994/01 to 2016/12. ANN used in this study is based on Multi-Layer Perceptron (MLP) Model. MLP architecture is decided by trying various combinations of number of hidden layers, different transfer functions and learning algorithms in order to get optimum prediction result.

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**Keywords: Electricity Consumption Forecasting, Monthly Electricity Consumption, Artificial Neural Network**

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## **The UK Oil and Gas Industry: Progress towards Sustainable Operations**

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This paper examines the enablers and inhibitors of sustainability in the oil and gas industry. The research reported here is different from previous studies, in that it presents a sector focused studies of the emergent facilitators and impediments to sustainability whilst establishing empirical link between environmental sustainability performance and organisational competitiveness. A survey by questionnaire research methodology was adopted. The data was collected from across the UK oil and gas industry. A total of five hundred and fifty questionnaires (550) were sent out and 162 responded, giving a response rate of 29.5%, but only 112 were fully completed and subsequently used for analysis with SPSS 21 for Windows. The results show that adoption of sustainability practices in the industry leads to improved environmental performance and economic performance, which, in turn, positively influence operational performance. The operational performance enhances organizational competitiveness. The results further points to a sustained level of sustainability implementation in the oil and gas industry. The drivers of sustainability include energy conservation, increase market share, environmental advocacy pressures and resources depletion. However, legal and regulatory pressure was not seen as a driver. The inhibitors of sustainability practices are inappropriate infrastructural facilities, unskilled employees, insufficient information and high cost of adoption.

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**Keywords: sustainability, enablers, inhibitors, oil and gas, and competitiveness**

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**Selecting the Best Vendor Using Analytic Network Process (ANP)  
Method: Elimination of Corrosion Issue**

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Effective and successful projects could not be considered without competent vendors or service providers. Selecting competent vendors could not be based on only hierarchically sorted criterias, since none of the criterials could be solitary. Multi Criteria Decision Making (MCDM) methods are used to evaluate potential vendors and Analytic Network Process (ANP) method supports modelling dependencies and feedback between elements in the network. Therefore, a case problem a firm in Ankara had faced is operated and evaluated using ANP method in this study. Firm had a corrosion problem on one of the their delivered parts and requested solutions from its four potential vendors. Vendor selection according to proposed solutions and conditions is a problem for the firm in order to make the most effective decision within six main selection criterias; engineering solution, cost, delivery schedule, location, quality and guarantee.

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**Keywords: multi criteria decision making, analytic network process (ANP), vendor selection, supplier evaluation**

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**Investigation of the Semi-Markovian Random Walk Process with Normal Interference of Chance**

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In this study, is an important class of the semi-Markov processes is considered. The semi-Markovian random walk with a normal interference of chance is constructed mathematically and the ergodicity of the process is proved under some weak conditions. Furthermore, exact expressions for the ergodic distribution function and the characteristic function are determined. Using these expressions the first four moments of the ergodic distribution are expressed by the first five moments of a certain boundary functional. Later, asymptotic expansions with three terms are found for the moments of the boundary functional using Dynkin principle. By using these results, the asymptotic expansions are proposed for various integrals related to moments of the boundary functional. Furthermore, asymptotic expansions with three terms for the first four moments of ergodic distribution of the process are found as follows:

$$E(X) = \frac{\alpha}{2} + c_{11} + \frac{c_{12}}{\alpha} + o\left(\frac{1}{\alpha}\right), \quad \text{when } \alpha \rightarrow \infty \quad \text{Here,}$$

$$c_{11} = \tilde{m}_{21} - \frac{1}{2} \tilde{\mu}_{21}; \quad c_{12} = \frac{1}{2} [\sigma^2 + \tilde{\mu}_{21}^2 - \tilde{\mu}_{31}^2];$$

$$\tilde{m}_{k1} = \frac{m_k}{km_1}; \quad \tilde{\mu}_{k1} = \frac{\mu_k}{k\mu_1}; \quad m_k = E(\eta_1^k); \quad \mu_k = E(X_1^{+k}); k = 1, 2, 3$$

$$E(X^2) = \frac{\alpha^2}{3} + c_{21}\alpha + c_{22} + o(1); \quad \text{when } \alpha \rightarrow \infty \quad \text{Here,}$$

$$c_{21} = \tilde{m}_{21} - \frac{1}{3} \tilde{\mu}_{21}; \quad c_{22} = 2\tilde{m}_{21}^2 - \tilde{m}_{31} + \sigma^2 - \tilde{m}_{21}\tilde{\mu}_{21} + \frac{1}{3} \tilde{\mu}_{21}^2$$

$$E(X^3) = \frac{\alpha^3}{4} + c_{31}\alpha^2 + c_{32}\alpha + o(\alpha), \quad \text{when } \alpha \rightarrow \infty \quad \text{Here,}$$

$$c_{31} = \tilde{m}_{21} - \frac{1}{4} \tilde{\mu}_{21}; \quad c_{32} = 3\tilde{m}_{21}^2 - \frac{3}{2} \tilde{m}_{31} + \frac{3}{2} \sigma^2 + \frac{1}{4} \tilde{\mu}_{21}^2 - \tilde{m}_{21}\tilde{\mu}_{21}$$

$$E(X^4) = \frac{\alpha^4}{4} + c_{41}\alpha^3 + c_{42}\alpha^2 + o(\alpha^2), \quad \text{when } \alpha \rightarrow \infty \quad \text{Here,}$$

$$c_{41} = \tilde{m}_{21} - \frac{1}{5} \tilde{\mu}_{21}; \quad c_{42} = 4\tilde{m}_{21}^2 - 2\tilde{m}_{31} + 2\sigma^2 + \frac{1}{5} \tilde{\mu}_{21}^2 - \tilde{m}_{21}\tilde{\mu}_{21};$$


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**Keywords:** semi-markov process, random walk, ergodic distribution, boundary functional, asymptotic expansion

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**NCM** *Conferences*

